RADIO-ELECTRONIC ENGINEERING EDITION

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PRINCETON UNIVERSITY
PRINCETON, N. J.

RADIO & TELEVISION NEWS

A ZIFF-DAVIS PUBLICATION

AUGUST
1952

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IN THIS ISSUE

ELECTRONICS ON THE WEST COAST

DECISION ELEMENTS

ROBLEMS OF THE TV THAW

NBS CORONA LABS

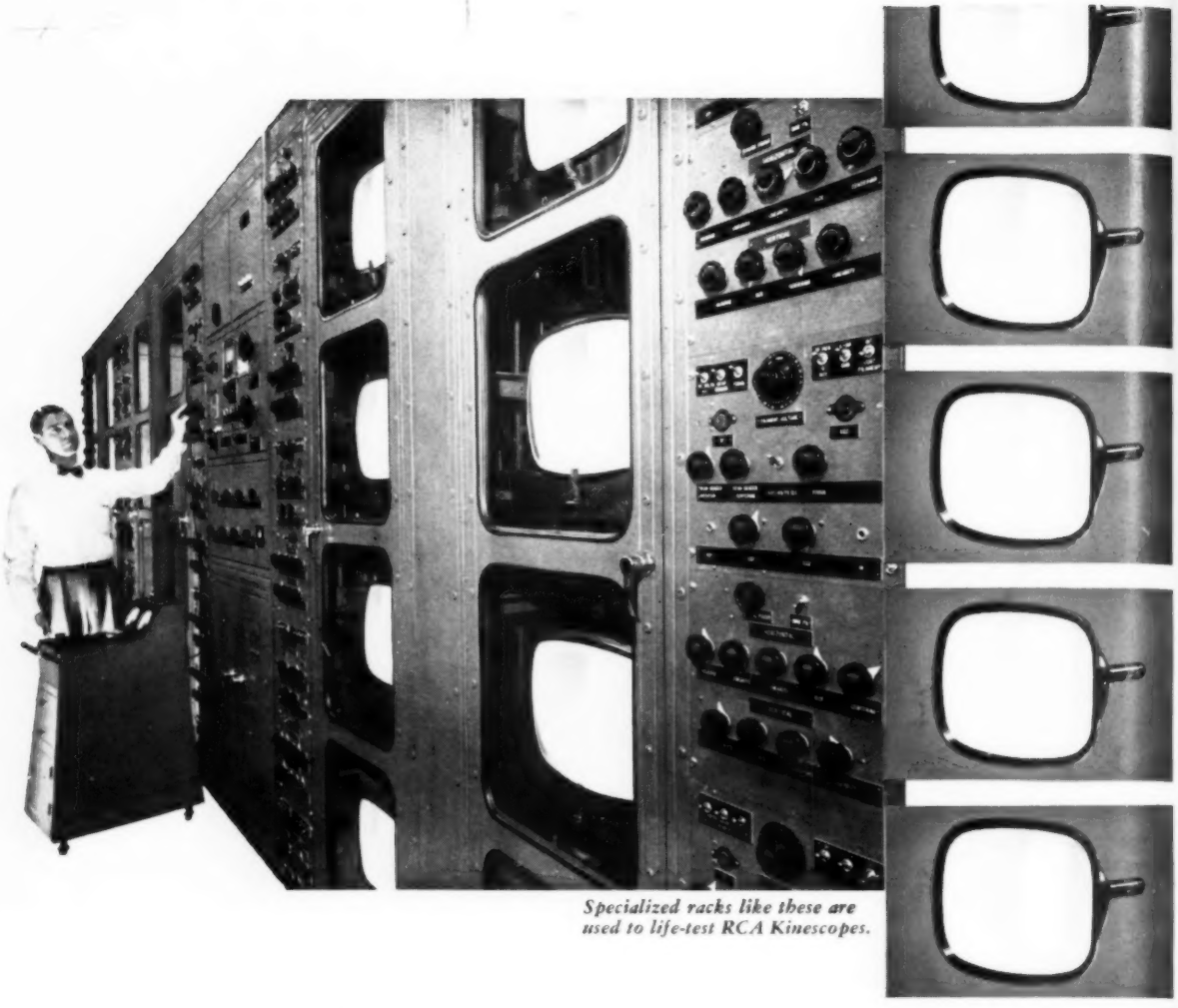
CROWAVES FOR THE "HAM"

IVERSAL DESIGN CURVES
R TONE-CONTROL CIRCUITS

ELEVISION PICTURE TUBE
REPLACEMENT GUIDE
("Data-Print" No. 4)

HE "DIALAUDIO" SYSTEM

INEMAGNETIC RECORDING
(See Page 46)



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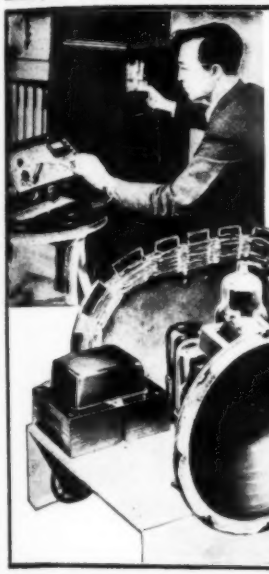

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"I accepted a position as Radio and Television Technician . . . was promoted to manager of Television Service and Installation."—L. HAUGER, San Bruno, California.

"Have my own shop. Am authorized serviceman for five manufacturers and do servicing for 7 dealers."—P. MILLER, Maumee, O.

"Four years ago, a bookkeeper on a hand-to-mouth salary, am now a Radio Engineer ABC network."—N. H. WARD, Ridgefield, Park, New Jersey.

"When I enrolled, had no idea it would be so easy to learn. Have equipped my shop out of spare time earnings. I am clearing about $40 to $60 a month."—J. D. KNIGHT, Denison, Tex.

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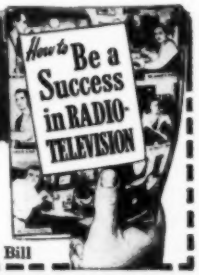

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COVER PHOTO: Robert Mitchum, star of the Wald-Krasna production "The Lusty Men," on location. RCA's portable magnetic recorder-reproducer equipment was used in this filming. (Ektachrome by J. Dale Healy and Alex Kahle)

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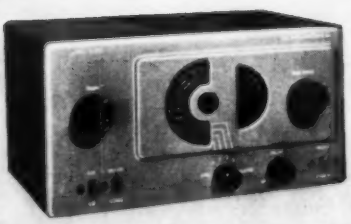

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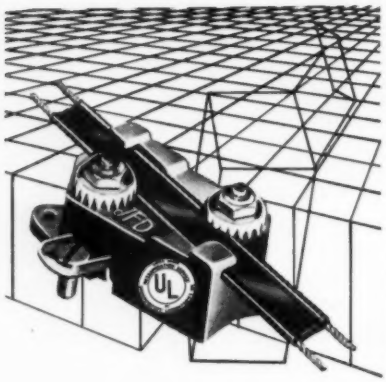

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BY THE EDITOR

A REPORT ON EIDOPHOR—FCC, PLEASE NOTE!

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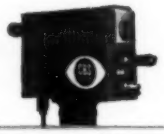

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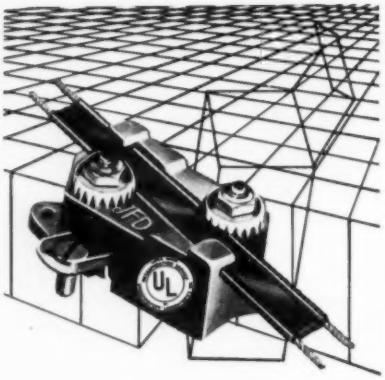

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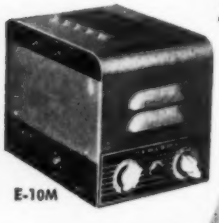

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By RADIO & TELEVISION NEWS'
WASHINGTON EDITOR

TELEVISION, since its inception a topic of teeming interest, has sparked, with the appearance of that famous sixth report on allocations, the most fiery debates on record, not only within industry circles, but also within the official family of Commissioners in Washington. Even those who have been quite docile have begun hammering away.

In a pounding effort to support the government's decision and its plan, veteran radioman and FCC Commissioner, George Sterling, told members of the Maryland-DC Radio and TV Broadcaster's Association, meeting in Ocean City, Maryland, that it seems as if some of the critics of the decision have relayed a frightening impression that the freeze-lift program was based on a . . . "conglomeration of master gimmicks dreamed up by a bunch of diabolical bureaucrats whose main purpose in life was to do damage to the television broadcasters and viewers." Emphasizing that such a distressing view was unwarranted, Sterling asked his listeners to take a closer look at these opinions and determine for themselves if there is ". . . any justification for the belief that the majority's decision was spawned by Satan himself or five or six of the fallen Angels."

Declaring that he was quite perplexed by the criticism that the Commission did not make adequate provision for the interests of the smaller cities, the FCC's technical expert said that if there was any aspect of the decision which should not be criticized, it was the Commission's recognition of the small cities. To support this comment, the record was described, and it was pointed out that 1274 cities now have one or more assignments, with 892 having one channel, while 176 have a couple of assignments. "I think it is clear," Sterling said, "that adequate provision has been made for potential local television service." Comparing the TV plan with AM broadcasting provisions, the Commissioner added that 1359 cities have one or more stations, and of this number 971 have but one station and 199 but two stations. The present decision, it was noted, permits cities without assignments in the table to come in at any time to obtain an assignment.

Commenting on the critics' views that the separations between the very-high stations were too wide, the Commissioner said the wider separations permitted more assignments. "As a matter of fact," Sterling added, "unless we reduce separations substantially, the number of additional assignments that we would pick up by reduced separations would be few. . . . And if we did take such action, we would be employing separations below those necessary to insure interference-free service." Such a move, he noted would roar us back to the ice age.

Hitting at the allegations that the Commission has been arbitrary and capricious in refusing to add a third or fourth very-high channel to one of the larger cities, Sterling asked his audience if they heard about . . . "those persons who live far away from larger cities, those persons who would receive interference rather than service because of the addition of this third or fourth channel for a large city?" He pointed out that grade *B* service, upon which sparsely settled and rural areas depend, would be destroyed, if the giant metropolitan center received the additional grade *A* service, so boldly requested. The Commissioner felt that only if the interests of the smaller cities and those residing in outlying areas were disregarded at this time, could mileage separations be reduced. However, he added . . . "this does not mean that the Commission cannot at a future date make changes in the table, when television is started and we have more engineering data. . . . We might very well some day reduce the mileage separations. . . . We shall learn more as new stations are activated. . . . But the existing propagation data does not permit a reduction in separations at this time."

Striking away at those who declared that the safety factor was a "mumbo-jumbo created to justify wider separations" the Commissioner declared that this . . . "is far from the truth." Describing the safety factor as a means of insurance to prevent interference, with the service information now available, Sterling said that regardless of which licensing procedure is used, a safety factor would have to be included to determine separations. "The data which currently exists must be the basis of any plan, whether it be the Commission's or one proposed by our critics," the FCC rep said. Continuing his blast, Sterling added: "Our critics are faced with the same problem of the completeness of the engineering data, and it is no answer for

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Fabulous 10 Element Z-Match Yagi

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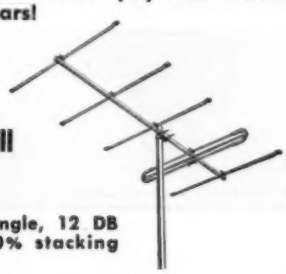

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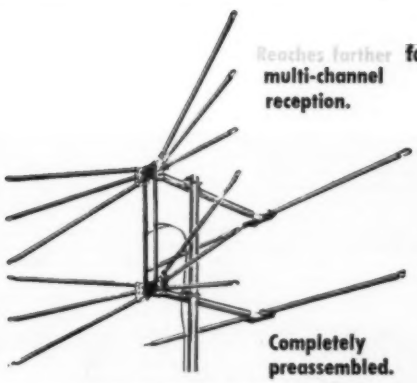

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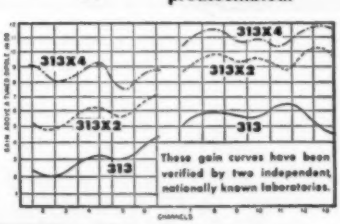

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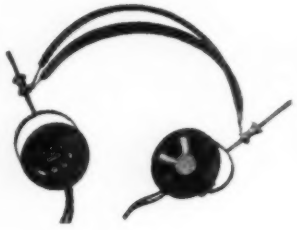

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them to state only that the Commission admits its ignorance of the ultimate in engineering facts. Manifestly, our critics can only rely on the very self-same facts."

Reviewing the so-called disparity between very-high and ultra-high coverage, the Commissioner indicated that he felt that eventually this problem will be minimized. "One thing is certain," he said, "u.h.f. will, in general, provide a TV service free from the effects of several forms of interference that plague v.h.f. frequencies. . . . I sincerely believe that u.h.f. will be a success. Despite all of the criticisms, and what might almost be termed a campaign of terror to scare people away from u.h.f., some of our most prominent and experienced AM broadcasters are reportedly ready to seek u.h.f. assignments in many cities."

Drawing a parallel between the early lack of interest in TV and the present reluctance on the part of some to accept the higher frequencies, Sterling said that . . . "those entrepreneurs who were willing to risk their capital in order to bring a new medium of communication to the public are now very successful, and are reaping the benefits of their courage and faith. . . . Let us hope that all who are not yet in television heed the lesson to be learned from those who could have afforded to enter television early but did not."

ELSEWHERE, allocation decision dissenter Commissioner Robert Jones continued his stinging tirade against the ruling, painting bleak outlooks for TV. In Pittsburgh, before a combined session of the Radio and Television Club and Advertising Club, he said that it might be five years before the "Steel City" would get its second TV station. Jones' attack so disturbed the city's mayor that he asked for appointments with House Speaker Sam Rayburn and Commissioner Frieda Hennock, hoping that discussions with them might provide a solution to the problem. The Commissioner's words irked and simply scared many too, who felt that his outbursts would delay issuance of authorization, by lending support to the modification briefs now being prepared for the examiners and courts.

MEMBERS OF CONGRESS also displayed an active interest in the allocations, seeking to secure funds for more examiners who can approve authorizations. Aroused by the fact that it will be impossible to process the flood of applications that are expected, unless the examining staff is expanded, twelve members of the Senate Interstate and Foreign Commerce Committee petitioned the appropriation subcommittee to secure at least $800,000 for . . . "salaries and other expenses necessary for the employment of 20 examiner teams to be used exclusively for processing and hearing television applications during the fiscal year ending 1953."

The Senators told their colleagues

(*Continued on page* 103)

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Within the INDUSTRY

M. J. McNICHOLAS has been advanced to the post of manager of the special apparatus division of *Andrea Radio Corporation*, Long Island City manufacturer of television receivers.

Mr. McNicholas joined the company in May of 1951 and has been assisting in the procurement and expediting of government contracts. Prior to his association with *Andrea*, he was purchasing agent for *North American Philips, Inc.* with headquarters at Mount Vernon, New York.

* * *

VICTOR MUCHER, president of *Clarostat Mfg. Co.*, and Austin C. Lescarboura, advertising counsel, were recently honored by *Clarostat* officials and sales reps at a banquet held to pay tribute to the former shipping clerk who became president of the multimillion dollar corporation and the former science magazine editor who now heads his own advertising agency catering to the radio-electronic industry.

Both men received the company's traditional 25-year gold wrist watches and testimonial scrolls as tokens of appreciation for their quarter-century service to the organization.

* * *

FREDERICK PALMER has been named president of the newly-formed San Diego County Electronic Association, Incorporated.

Other officers named to serve with Mr. Palmer are: Upton Hildebrand, vice-president; William E. Stout, secretary; and C. J. Mahoney, treasurer. Directors of the Association include: John R. Dorsen, John Miner, George N. Cocoronis, Sonny Kahn, and Thomas O. Crawford.

The Association, with a growing membership of over one hundred electronic technicians, has been formed to establish, promote, and maintain the highest standards of ethical business practice and service among Association members and to render service to the public.

* * *

CAPITOL RADIO ENGINEERING INSTITUTE of Washington, D. C. recently celebrated its 25th anniversary in the radio and electronics field with a series of special events.

The highlight of the Silver Anniversary program was a banquet held at the Mayflower Hotel in Washington. George Bailey, executive secretary of the Institute of Radio Engineers, Inc., and president of the ARRL, was the principal speaker at this commemorative affair.

The school, which originally started as a one-man organization, now has expanded until it includes both resident and home-study curricula. During the war, the school prepared programs for training thousands of Army, Navy, and Coast Guard radio technicians. The extension courses are now being used by government agencies and a large number of private industries.

* * *

OLIN INDUSTRIES, INC. has acquired **RAMSET FASTENERS, INC.** of Cleveland, Ohio. The new subsidiary will continue operation under its present management as one division of the parent company's Arms and Ammunition Division . . . **ETRACO MANUFACTURING COMPANY** has announced a change in its corporate name and will henceforth be known as **HINDLE TRANSFORMER COMPANY.** The firm manufactures transformers and wire and cable assemblies at its plant in Flemington, New Jersey . . . **CONSOLIDATED ENGINEERING CORPORATION** of Pasadena, California has announced the formation of a new corporation, **CEC INSTRUMENTS, INC.**, which will function as a subsidiary organization to handle sales and service work on instruments manufactured by the parent firm.

* * *

NEWELL J. CORWIN has been appointed manager of the *General Electric Company's* Scranton, Pennsylvania, tube works.

The Scranton Works was purchased recently by the Tube Department from the company's Electric Sink and Cabinet Department and will continue under the direction of Neil C. Mulcock, present works manager, until the change in manufacturing operations has been completed.

Mr. Corwin has been associated with *G-E* since 1937. He is an engineering graduate from Rensselaer Polytechnic Institute. Prior to joining *G-E*, he was associated with the Boonville, New York, Power and Light Commission, and *Barker and Wheeler*, a New York City engineering firm.

* * *

"THE REPRESENTATIVES" of Radio Parts Manufacturers, Inc. recently named a new slate of national officers at its annual national delegates' and general members' meeting held in Chicago.

Norman B. Neely of the Los Angeles Chapter was named president; Russ Diethert (Chicagoland) was named first vice-president; Wally B. Swank (Empire State) is the new second vice-president; Dean A. Lewis (California)

6-color displays that prospects can't pass by!
Ann Blyth Says: "There's a good man to call for radio or television SERVICE!"
June Havoc Says: "Get your radio and television fixed right... RIGHT HERE!"
RADIO TELEVISION SERVICE
WITH SYLVANIA RADIO AND TV TUBES
We use SYLVANIA Radio and Television Tubes
Striking Ann Blyth and June Havoc streamers!

You can double your fall service business with this NEW SYLVANIA CAMPAIGN

Two gorgeous movie stars, Ann Blyth and June Havoc, feature their personal endorsements of your service in this brand new Sylvania advertising campaign for service dealers. On life-like window displays and streamers, they recommend *you* just the way they will in the big Sylvania ads in *Collier's, Life, Look,* and *The Saturday Evening Post,* which will appear this Fall.

In addition, the Sylvania Campaign offers you four sets of personalized mailings imprinted with your name, address and phone number. All of the mailing pieces have stamps already attached. You pay *NO POSTAGE!* Radio spot announcements, and reminder stickers for your customers' sets round out this sure business-attracting kit!

And all you pay is *just 2 cents per prospect per month* for the mailers. All the rest is absolutely FREE . . . even the postage on the mailers! Call your Sylvania Distributor today, or mail the coupon below.

"Better radio and television service means more fun for you ... STOP HERE"
RADIO TELEVISION SERVICE
4 sets of mailers with postage already attached! Radio announcements!
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RADIO ANNOUNCEMENTS
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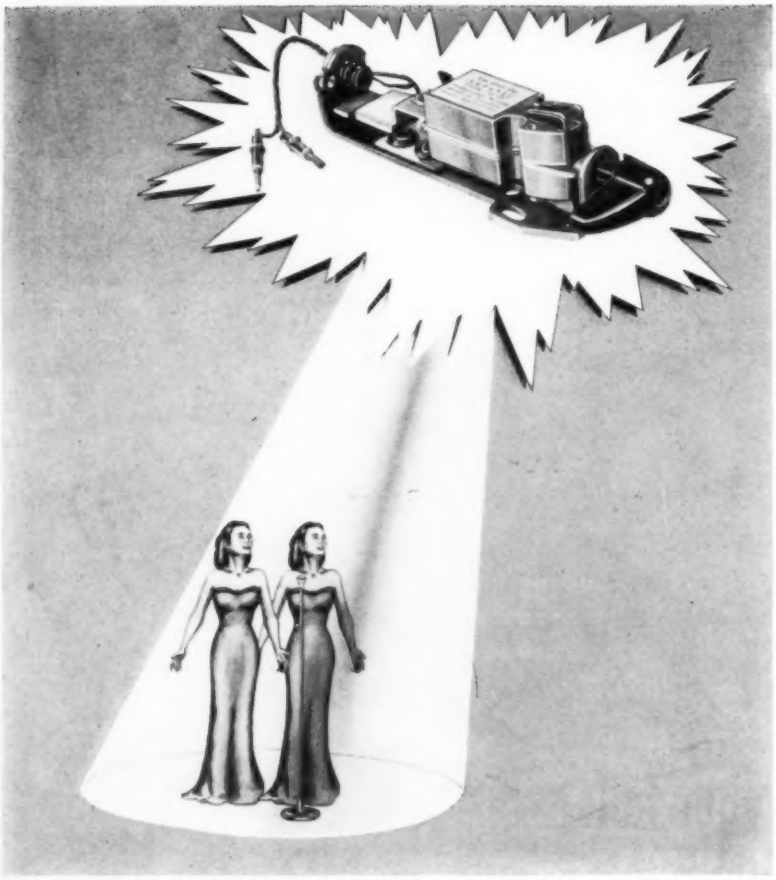

The highest praise of technical critics now goes to **Twin Performers**

Astatic's "Twin CAC" Turnover Cartridge Captures, as No Other Turnover Cartridge Can, the Full Glory of the Finest Music on Records.

Laboratory test it, or simply listen to it. On all high fidelity counts, for brilliance of tone, for smoothness of response, for frequency range, by any standard . . . you, too, will recognize the unmatched excellence of Astatic's new "Twin CAC," turnover pickup cartridge, the Model CAC-D-J.

You can see the great difference as readily as you can hear it. The radical design principle combines two complete CAC cartridge assemblies, back to back, on a common plate. No chance for needle interaction! For the first time in a turnover cartridge, the ideal output and response characteristics for EACH side can be established, independently, in one such record reproducing unit! Why not write for complete details of this sensational new Astatic product?

The single needle Astatic CAC-J has been acclaimed the perfect cartridge for microgroove records by many impartial experts. Model CAC-78J designates the single needle 78 RPM version.

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Astatic Crystal Devices manufactured under Brush Development Co. patents

will serve as third vice-president; James P. Kay (Missouri Valley) is the new secretary; while Royal J. Higgins (Chicagoland) will serve as treasurer.

* * *

JOSEPH S. WRIGHT has been appointed assistant general counsel for *Zenith Radio Corporation* of Chicago.

Mr. Wright has been an attorney with the Federal Trade Commission since 1936 and since 1947 has been the Commission's assistant general counsel and chief of its compliance division.

Prior to 1947, he served variously as an attorney-examiner, reviewing attorney, special legal assistant to the chairman, and trial attorney. From 1942 to 1945 he was on active duty with the U. S. Navy, attaining the rank of lieutenant-commander before his discharge.

* * *

SYLVANIA ELECTRIC PRODUCTS INC. has leased 20,000 square feet of warehouse and office space in a new building in Seattle, Washington, that will serve as the company's headquarters for sales and service operations in the Pacific Northwest. The new building is located at 3466 East Marginal Way, Seattle . . . **ELECTRONIC SUPPLY CORPORATION** has moved to new and larger quarters at 41-08 Greenpoint Avenue, Long Island City, N. Y. The new location provides over 4000 sq. ft. of floor space to house the firm's distribution activities . . . A new plant for the manufacture of "Speed Nut" fasteners in Canada has been opened by **DOMINION FASTENERS, LIMITED** of Hamilton, Ontario. The plant will supply Canadian industry with more than 100 million units annually . . . **MOTOROLA INC.** has opened a new West Coast parts and service department at 811 South B Street in San Mateo, California . . . **CONRAC, INC.,** manufacturers of custom-built television receiving sets, etc., has opened a new sales and display room at 7264 Melrose Avenue in Hollywood, California . . . **GERBER SALES CO.** of Boston, Mass. has opened a new Connecticut office in the First National Bank Building, 42 Church Street, in New Haven . . . The **SHELDON ELECTRIC DIVISION** of **ALLIED ELECTRIC PRODUCTS INC.** has acquired new branch office and warehousing facilities at 2724 Leonis Boulevard in Los Angeles. The new quarters provide 21,000 square feet of air-conditioned space . . . **MOTOROLA INC.** has leased certain manufacturing facilities from **STROMBERG-CARLSON CO., LTD.** in Toronto Canada and has formed a new subsidiary, **MOTOROLA CANADA, LTD.** which will manufacture and sell television receivers as well as a complete line of home and portable radios for the Canadian market . . . **H-B INSTRUMENT COMPANY** is in production in its newly-acquired plant at American and Bristol Streets in Philadelphia.

(*Continued on page* 85)

MICROWAVES for the "HAM"

Fig. 1. A 6V6 tube mounted in a wave guide and cavity system for generating microwaves with a conventional receiving tube.

By
SAMUEL FREEDMAN
W6YUG

The growing problem of TVI will eventually force hams to "move upstairs" into the microwave bands.

SINCE May 1945 the Federal Communications Commission has reserved seven bands of microwave frequencies for the exclusive use of hams. Ideally located between 420 and 22,000 mc., this allocation provides over 2,000,000 kilocycles of spectrum as compared to the 16,000 kilocycles now used for approximately 99 percent of all ham transmissions.

It is now seven years since these bands were assigned to the hams yet, with the exception of the 420-450 mc. band, activity in these bands is negligible. This state of affairs is inconsistent with the ham's traditional role as a "radio pioneer."

The fact that 15,000,000 television receivers are now in the hands of the public with more to come as new stations bring larger areas of the country within the fold will provide a powerful impetus in "kicking the amateurs upstairs." If there is to be any lasting peace and harmony between the millions of televiewers and the thousands of amateurs, the only real solution lies in a voluntary, or perhaps involuntary, exodus of radio hams to the high frequency, or microwave, side of the television frequency bands.

Ham transmissions on the present popular amateur bands will continue to cause interference in nearby receivers with the attendant protests from irate TV fans. Although it is technically and theoretically possible to eliminate such interference, it is sometimes financially unfeasible to do so. The mere fact that one amateur station can operate in a certain area without causing interference in nearby television receivers is no guarantee that the equipment will continue free from TVI. All the ham has to do is change frequencies or equipment or for a neighbor to buy a different type of TV receiver and the problem of interference becomes critical.

The public's investment in television receivers now aggregates three billion dollars as compared to the approximately thirty million dollars which hams have tied up in their equipment. Thus the hams' stake in radio gear has been exceeded a hundredfold by the public's investment in home receivers. In terms of the number of households affected (or in votes at election time), the relationship is even more top-heavy. At the present time there are over 200 times more television households than there are ham radio homes. Even the ham often finds himself in the unenviable position of having his ham equipment interfere with his own television reception! A showdown is in the making at the present time and eventually the ham will wind up in the microwave region and, in the opinion of the author, when this happens it will be the greatest "blessing in disguise" ever vouchsafed the radio art.

The situation is even more critical than it was in 1922 when radio broadcasting developed virtually overnight into a hydra-headed monster of gigantic proportions. At that time, amateur radio had to move up in the radio spectrum and operate on the high frequency side of radio broadcasting. This enforced move made the ham's equipment and techniques obsolete and unsuitable. Specifically he had to discontinue operations on frequencies of 1500 kc. and lower where he had employed a spark coil or rotary spark transmitter, crystal receivers, monstrous antennas, and wireless telegraphy. He was forced to operate in the band from 1500 kc. upward with equipment requiring the use of vacuum tubes and careful attention to impedance matching.

In a matter of months this enforced move resulted in several important developments. The move led to the discovery of the Kennelly-Heaviside layer, reliable determination of sky wave skip phenomena, and the establishment of the advantages of short-wave operation.

The ham was delighted to discover that with a fraction of the power needed on the lower frequencies he could communicate world-wide—even to the antipodes. Even a small receiving tube, such as the now-obsolete UV201A, was sufficient to serve as a transmitter to reach all the way to Australia. The range of communication jumped from the usual hundred miles or less to distances circling the globe. Furthermore the ham could make his contacts by voice or radiotelephony instead of code or radiotelegraphy.

Today a similar situation exists except that now the amateur will move to a much higher and more spacious spectrum. He can achieve efficiencies in circuitry never before possible since he can dispense with lumped or specially-provided inductances, condensers, and even resistors with their losses. He can develop and control the electric and magnetic fields through distributed inductance, capacitance, and impedance by means of the physi-

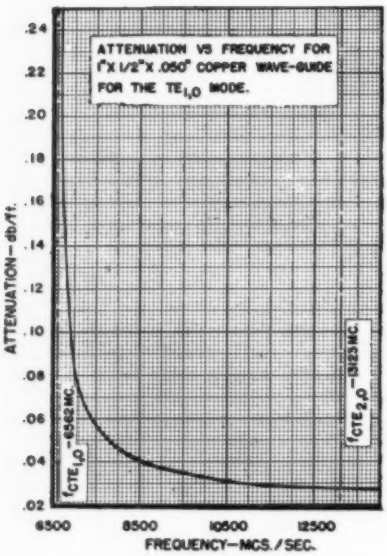


Fig. 2. Graph of attenuation vs frequency for a 1 x ½ inch wave guide suitable for 10,000 to 10 520 mc. ham band operation.

cal arrangement of simple metallic shapes.

On microwaves, the amateur will again be recognized as one of the nation's most valuable sources of original research and experimentation instead of a mere nuisance as he has now become in the opinion of millions of televiewers. On microwaves, where amateur radio now more properly belongs, hams by their very number and geographical distribution will open a new era in amateur radio. They will quickly overtake the billions of dollars' worth of professional microwave development that has thus far taken

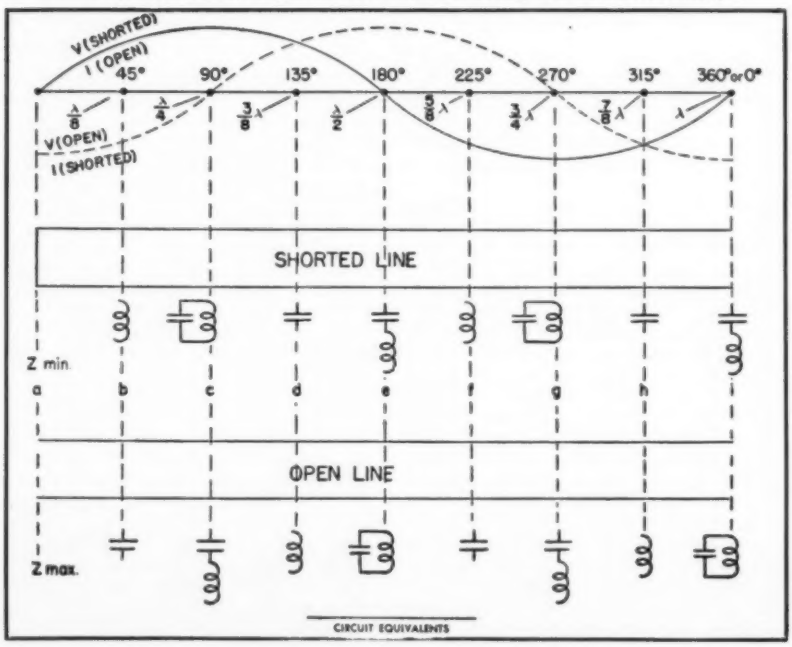
MEDIUM FREQUENCIES		TOTAL KC.
1800-1825 kc.	25 kc.	
1875-1925 kc.	50 kc.	
1975-2000 kc.	25 kc...	100
HIGH FREQUENCIES		
3500-4000 kc.	500 kc.	
7000-7300 kc.	300 kc.	
14,000-14,350 kc.	350 kc.	
21,000-21,450 kc.	450 kc.	
26,960-27,230 kc.	270 kc.	
28,000-29,700 kc.	1700 kc...	3,570
VERY-HIGH FREQUENCIES		
50,000-54,000 kc.	4000 kc.	
144,000-148,000 kc.	4000 kc.	
220,000-225,000 kc.	5000 kc...	13,000
ULTRA-HIGH FREQUENCIES		
420-450 mc.	30,000 kc.	
1215-1300 mc.	85,000 kc.	
2300-2450 mc.	150,000 kc...	265,000
SUPER-HIGH FREQUENCIES		
3300-3500 mc.	200,000 kc.	
5650-5925 mc.	275,000 kc.	
10,000-10,500 mc.	500,000 kc.	
21,000-22,000 mc.	1,000,000 kc...	1,975,000
Total Spectrum		2,256,670

Table 1. Currently authorized ham bands.

place without his participation. He can ultimately save the taxpayers untold sums which are now going into microwave research and development. In the past decade it has been demonstrated that professional microwave activities have been unable to keep microwaves simple and inexpensive enough to encourage their widespread usage. Only the radio amateur is in a position to substitute empirical (cut-and-try) methods for the calculated complex and planned procedures of government and industry. There are relevant discoveries yet to be made which can best be made by a free exchange of information and experiences by amateurs operating largely "without rhyme or reason" techniques.

The radio amateur today has a large number of frequencies in which he is free to operate. These frequency bands are listed in Table 1.

Fig. 3. How coils and condensers, alone or as series or parallel circuits, can be eliminated by moving along a quarter wavelength within any over-all half wavelength.



It is estimated that most of the licensed amateur radio activity in the United States is concentrated in the high frequency band, representing a total of only 3570 kc. out of the total 2,256,670 kc. assigned to hams. They, plus the bulk of the rest of the hams operating on the 50-54 mc. and 144-148 mc. bands, are the source of the TVI. The hams have congregated into 11,670 kc. of the amateur spectrum subject to TVI while doing little to equip themselves and engage in operations on the balance of the 2,245,000 kc. assigned to them. They are jammed into less than one-half of one per-cent of the spectrum and are ignoring the more than 99½ per-cent of the spectrum in which TVI would be virtually nonexistent.

Microwaves have been generally recognized to be the frequencies between 300 and 3000 mc. (known as ultra-high frequencies) and between 3000 and 30,000 mc. (known as super-high frequencies). The FCC has allocated 9.8 per-cent of all ultra-high frequencies and over 7.3 per-cent of all super-high frequencies for the exclusive use of hams. On a non-exclusive basis, the amateurs may also use all frequencies above 30,000,000 kc. on to infinity or cosmic rays, including the bands known as "infrared," "light," "ultra-violet," "x-rays," "gamma rays," and beyond.

Microwave Techniques

Basically, the difference between microwave operation and transmissions at the lower frequencies is a matter of equipment. In the case of microwave operation there is no need for specially-provided transformers, coils, condensers, or resistors. As shown in Fig. 3, all of these components are replaced by positions taken along a closed or shorted pipe (called a wave guide). In practice, this pipe is usually rectangular with its wide dimension exceeding a half wavelength. Fig. 4 is a photograph of a commercially-available model and an improvised unit made of screen wire. The home-built unit can be made out of foil or any other conductive or non-conductive material as long as the inner surface is a good conductor. If a simple can is used instead of a pipe, the unit is called a "cavity." Only the frequencies which have electric and magnetic field distributions that fit inside of such a can or cavity will exist in same. Thus, it is a frequency controlling element that replaces quartz crystals on the lower frequencies. For the amateur frequencies, the cavities can have a "Q" on the order of 10,000 or more.

On the frequencies that the radio amateur best understands (frequencies below 450 mc.), he has been conveying energy by means of conductors such as circuit wiring. On the microwave frequencies, he conveys the current by means of electric and magnetic field displacements within the wave guide. In other words, microwaves are characterized by the displacement technique while conventional frequen-

cies use conduction or the cumbersome electric power line technique.

On microwaves, the phenomenon of space radio propagation is extended to the passage of energy within the equipment itself and the transmission line system. The method by which this takes place is shown in Fig. 5. One side of the wave guide pipe (Fig. 4) simulates the ionosphere while the opposite side simulates the earth. Fig. 5 shows a several-hundred-foot medium frequency broadcasting tower used for sky wave transmissions by reflections between the ionosphere and the earth. Fig. 5A shows a rectangular pipe (artificial or fabricated wave guide) which replaces "Nature's wave guide" and performs the same function. In Fig. 5A the pipe is less than a half wavelength or at cut-off. Energy will not proceed down the pipe and attenuation is maximum. Fig. 5B shows what happens if the wave guide is wider than a half wavelength. Energy will propagate down the wave guide. Fig. 5C shows what happens if the wave guide is made even wider. Energy will be propagated even better with less attenuation or losses. In order to keep this explanation simple it is desirable that the dimension of the guide not approach or exceed a full wavelength. If the guide is wider than a full wavelength, the energy divides itself and becomes similar to two wave guide pipes. Two energy patterns or modes would then exist side by side. In addition, the narrow side of the rectangular wave guide would accommodate a pattern. The narrow side walls function to keep the other two walls properly spaced. They also determine how much power can be handled by the wave guide. The wave guide of Fig. 4 can handle up to 3,200,000 watts of power without breakdown or flashover. Fig. 2 is a graph of the performance of a wave guide suitable for the 10,000 to 10,500 mc. amateur microwave band. The rectangular pipe has an inside dimension of .9" x .4". Part *A* in Fig. 5 corresponds to 6562 mc. on the graph of Fig. 2. Part *B* in Fig. 5 might correspond to 7500 mc. on the graph of Fig. 2. Part *C* might correspond to 10,500 mc. on the graph of Fig. 2. At 13,123 mc., two modes of energy will form, changing this particular energy designation from "cut-off frequency of transverse electric mode 1,0" to "cut-off frequency of transverse electric mode 2,0."

It is preferable to operate in the dominant or first mode for reasons of simplicity. It is feasible, and research has been conducted along these lines, to use several modes, each a separate channel of communication. If the wave guide is two wavelengths in width, there would be four modes of energy. If it is three and one-half wavelengths in width, there would be seven modes of energy, etc. Fig. 2 also shows the attenuation in decibels-per-foot for a particular size wave guide. In this case, in the 10,000 mc. amateur microwave band, it is less than .035 db-per-foot. The wave guide could be over 28 feet long before the energy would be attenuated 50 per-cent. By selecting an appropriate size wave guide, minimum attenuation can be obtained for any frequency. This same concept holds true even on low frequencies except that at 4000 kc., for example, the wave guide pipe would have to be substantially greater than a half wavelength, or 123 feet in width. It is only because of the shorter wavelengths which make possible convenient physical dimensions that it is possible to take advantage of microwave techniques that would be impossible or unfeasible to employ on lower frequencies. The technique would otherwise function on any wavelength as long as physical dimensions and associated costs are not prohibitive. The amount of power which such a wave guide can handle depends upon the height of the guide. For the wave guide of Fig. 2, the power handling capacity is 235,000 watts. The smallest size wave guide, such as the one required for 21,000 to 22,000 mc., will still exceed 60,000 watts power handling capacity. Since communication at microwave frequencies can be carried on with a fraction of a watt power (even microwatts) there need be no concern that the user might, in any way, exceed the power handling capacity of a wave guide.

To further appreciate wave guide phenomena, one need but recall what happens to an auto radio receiver when the car is driven through an underpass. The underpass is, in reality, a wave guide. Since the broadcast might be 1000 kc. (300 meter wavelength), such an aperture or wave guide would have to exceed 500 feet in diameter in order for the signals to go through. Police radios and two-way vehicular systems have no difficulty in communicating in such a wave guide since

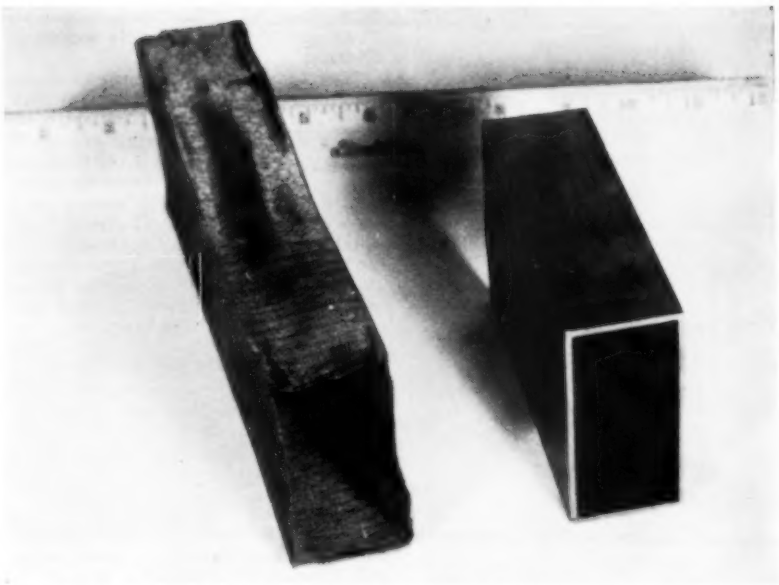


Fig. 4. Commercial vs homemade wave guide for the 3300-3500 mc. band. This 3"x1½" wave guide has a power handling capacity of nearly 3,200,000 watts.

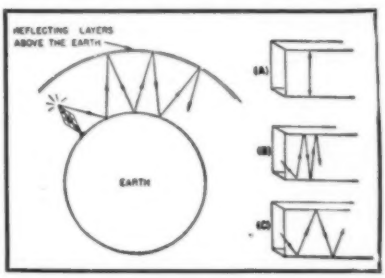
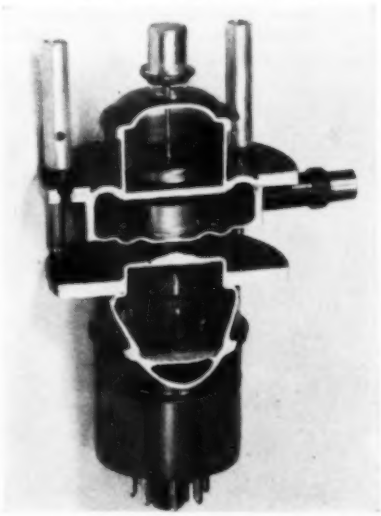


Fig. 5. Nature's wave guide on low frequencies vs fabricated wave guides on microwaves. Wave guide is shown at cut-off, above cut-off, and at even higher values.

Fig. 6. Cutaway view of reflex klystron. The negatively biased repeller atop the tube turns the electrons back to the positively biased grids. A cavity circuit is set up between pairs of grids. A tube of similar type can be used at 3300-3500 mc.



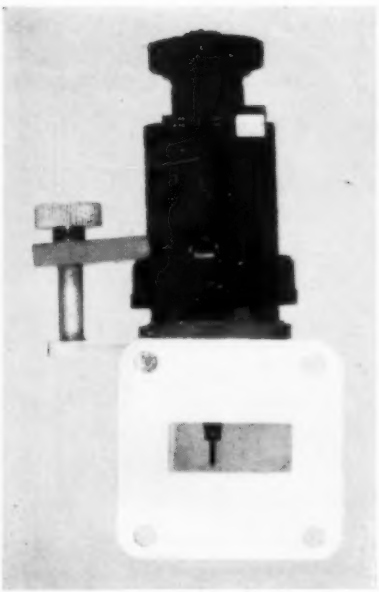


Fig. 7. A reflex klystron tube with its output coupled into a wave guide as required for operation in the 10,000 to 10,500 megacycle ham band.

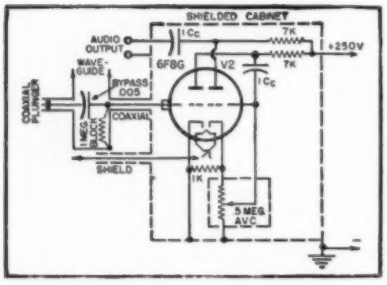


Fig. 8. Circuit of one-tube microwave receiver using conventional-type tube.

their operating wavelength is substantially shorter and will fit inside such boundaries. The wavelengths involved for the amateur microwave bands range from as little as a half inch on 22,000 mc. to as much as 14 inches on 1200 mc.

There are many other methods of handling microwave energy of which the "G string" and the "helical coil" are particularly interesting examples. In the case of the helical coil, the coaxial inner conductor connection is extended into a coil which serves as a wave guide. With the "G string," the coaxial connector inner connection extends as a straight wire while the coaxial connector outer connection flares out into a horn which focuses the energy onto this straight wire.

Tubes for Producing Microwaves

There are several tube types or tube techniques for generating microwaves. Where one can be purchased at surplus, a reflex klystron is a useful means of generating microwave frequencies. Fig. 6 is a cross-section view of a type which is approximately correct for the 3300-3500 mc. amateur band. It has a cathode, a pair of grids, and a repeller. A repeller is equivalent to a plate but is biased negatively instead of positively. The grids operate at a high positive potential. A cavity connects to the grid extremities to form a tuned circuit. If modulation or audio is impressed on the repeller voltage, the tube will serve as an FM transmitter.

Fig. 7 shows how a reflex klystron tube is coupled to the wave guide. The output electrode extends into the wave guide as if it were a quarter-wave grounded antenna, in low frequency applications. Energy then propagates down the wave guide. An adjusting screw tunes the cavity contained within the tube itself. Such a tube and wave guide is nearly correct for the 10,000 to 10,500 mc. amateur microwave band.

Fig. 1 shows a conventional tube enclosed within a wave guide cavity. In this application only the tube frequencies which can exist for that size microwave plumbing are available and utilizable. The grid and plate leads can be adjusted external to the guide. The photograph also shows an elaborate wave guide attenuator consisting of a carbon-coated resistor that can be inserted into or withdrawn from the wave guide. A gauge is used to indicate how much attenuation is being inserted.

Other means of providing microwave energy include:

1. Tubes having very close interelectrode spacings while maintaining low orders of interelectrode capacitance by their geometrical design.

2. By using conventional tubes with the transit time between cathode and plate equal to more than a period of oscillation in order to maintain proper phase relations even though the transit time is too long with respect to the same period or cycle of oscillation. It can be corrected for a subsequent period. The electron transit time may take two or more periods of time to reach the plate from the cathode but it must arrive at the plate during the correct part of the period. This is accomplished by means of suitable voltages.

3. By use of a spark gap within a shielded wave guide. A spark gap generates the frequency spectrum while the wave guide plumbing enclosing or connected to it permits only the microwaves to propagate.

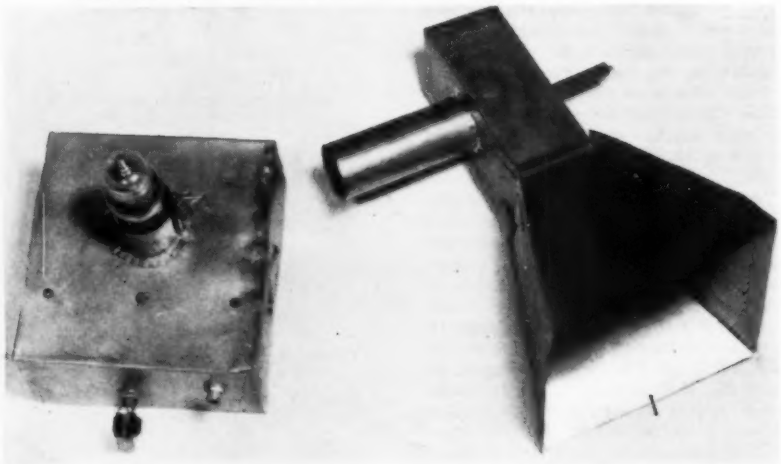
In its simplest form, a microwave transmitter is merely a signal source which may be a tube or a spark gap and a wave guide pipe. The outer end of the pipe will squirt energy into space from the end of such a wave guide. If a horn extends from that end, the energy may be concentrated or directed as desired. The beam may be sharpened or broadened by changing the length and angle of the flared horn.

The simplest microwave receiver is a silicon or other type of receiving crystal connected to a pair of headphones. A more elaborate receiver may consist of a crystal detector followed by several stages of audio or video amplification. Still more elaborate is a crystal mixer stage in which the crystal output is mixed with a local oscillator (which may be the transmitting tube) to yield an i.f. frequency which is then handled by a superheterodyne circuit similar to the one used on the lower frequencies.

Fig. 8 is the schematic of a one-tube microwave receiver used by the author in his laboratory experiments. The same tube serves as a combination r.f. amplifier, detector, first audio amplifier, as well as providing for possible a.v.c. connections. Fig. 9 shows how this receiver appears, complete with its antenna system made of brass foil. The horn and wave guide section slips over the tube with a coaxial tuning plunger connecting to the grid of the first half of the Type 6F8G tube. The antenna system comprises an electromagnetic horn, tapering to a round wave guide. The coaxial plunger, consisting of a movable short, permits ad-

(*Continued on page* 131)

Fig. 9. One-tube microwave receiver using single 6F8G tube. The horn unit comprises the antenna and transmission line when placed over the tube.



AUDIO GOES MOBILE

Over-all view of Electro-Voice's "Audio CaraVan"—a mobile sound studio and demonstration unit.

By making a complete line of high quality audio equipment accessible to the customer one firm hopes to stimulate its sales.

BELIEVING that high-quality audio equipment need only be heard to be sold, *Electro-Voice, Inc.* of Buchanan, Michigan has developed a unique mobile demonstrator which will tour the country and bring a flexible assortment of audio gear to the small-town listener as well as the urban music lover.

Designed to permit the customer to make his own "comparative listening tests," the "Audio CaraVan" has been set up to simulate rooms in a home or studio. Approximately 1850 cubic feet of space is available in the 12,000 pound, 38-foot trailer which is pulled by a *Chevrolet* cab-over-engine tractor.

Inside the "CaraVan" is displayed the company's line of cabinets, speakers, and speaker systems—all fed by broadcast-quality recording equipment such as *Ampex* and *Magnecord* tape recording and playback units, and *Rek-O-Kut* turntables equipped with *E-V* phono cartridges. All of this equipment is hooked into a console switching control system which enables the customer to make his own listening comparison tests.

In addition to these purely audio items, the "CaraVan" also carries a display of the company's television boosters and distribution systems.

The new "CaraVan" made its debut at the Parts Show held in Chicago in May. During the Show thousands of persons visited this unusual display-room-on-wheels and voiced their approval of the idea of taking the merchandise to the customer. This wholehearted endorsement of the scheme presages its enthusiastic acceptance by dealers throughout the country.

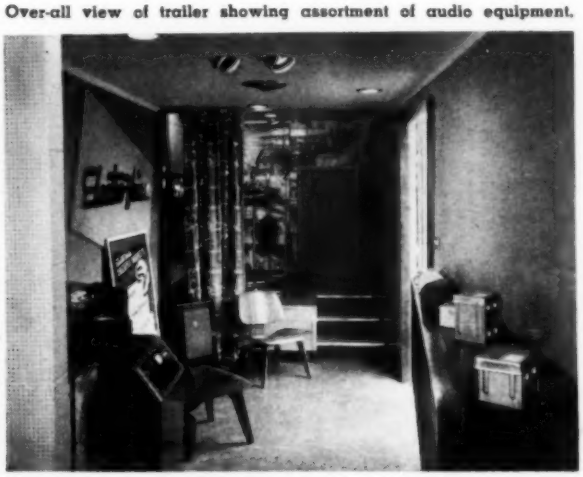
Should the idea go over as expected, the company plans to equip several more such trailers in order to cut down the time required to cover the country. Dealers will be invited to visit the "CaraVan" and, if they wish, bring along their prospective customers who will be allowed to test various combinations of the equipment that is displayed within the mobile unit.

The "CaraVan" may be headed your way—so look for the distinctively-designed trailer unit in your community. When it reaches your town, stop in and look around. You will be more than welcome to try out the equipment in various combinations until you find the audio units that best suit your needs.

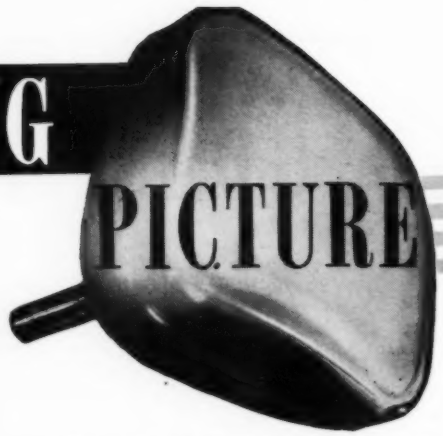
—30—

A customer selects audio equipment by means of control console.

Over-all view of trailer showing assortment of audio equipment.



SERVICING PICTURE TUBES



By
JOHN B. LEDBETTER
Eng., WKRC, WKRC-TV

Some useful hints on extending the life of TV picture tubes and improving tube performance.

WHAT would *you* do if restrictions suddenly were placed on picture tubes? This is a serious enough question at the present time, but it assumes even more serious proportions when you consider the rising popularity of large-screen receivers and the possibility of shortages in the near future. Obviously, the only course to follow would be the replacement of *inoperative* picture tubes as your supply allows and the disregarding of all other picture-tube troubles until the situation has been improved.

In many cases, a defective picture tube can be serviced or returned to normal by one of several simple operations. These are important to you *now* because their successful employment not only will extend the present life of the tube but will ease replacement problems later. These methods will be covered in detail in this article. Picture tube troubles usually are limited to one of the following:

1. *DEFECT: Loss Of Brilliance.* A gradual drop is normal (brightness usually drops off rapidly during the first 500 hours of use, then tapers off exponentially from then on). These changes are usually not too noticeable because the customer automatically compensates by adjusting the brightness control.

CAUSE: Barring possible troubles in the horizontal output circuit or in the high-voltage power supply (*i.e.*, weak tubes, defective filter condensers or second anode resistor, leaky terminal strip, etc.), low brightness can be caused by (1) a weak picture tube, (2) weak or misadjusted ion trap magnet, or (3) a heavy collection of dust and soot on the picture tube face and inside of the safety glass.

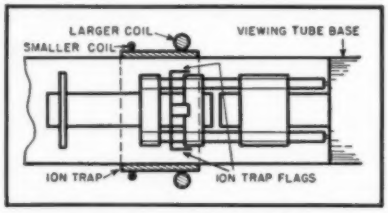


Fig. 1. Correct positioning of ion trap to give maximum brightness on the tube.

REMEDY 1: Substitute a new picture tube. If a new tube is handy, this may save time by either clearing the old tube from suspicion or positively identifying it as the defective unit.

REMEDY 2: Readjust the ion trap or try a new one. The original trap may be misadjusted as a result of tampering or accidental jarring, or the magnet may be partially demagnetized either from an accidental blow or from having been placed near an a.c. or strong d.c. field. Be sure the new ion trap is a duplicate type (single and double-magnet traps are *not* interchangeable), and see that the identifying arrow or colored dot on the magnet faces *toward* the bell or front of the picture tube.

Ion Trap Adjustment: Set the brightness control slightly above normal and slide the ion trap magnet slowly back and forth, at the same time rotating it slightly from side to side. Adjust for maximum brightness. Next, adjust the focus control for sharpest scanning lines and increase the brightness as far as possible before "blooming" or loss of focus occurs. Readjust the magnet carefully at this point for maximum brightness.

Note: On some picture tubes, *two* different positions of the magnet will give maximum brightness. The correct position is the one nearest the picture tube base (approximately over the gun flags. See Fig. 1). If neck shadow or rounded corners (Fig. 2) appear while adjusting, you may have to readjust the focus and deflection coils and recheck the centering adjustments.

REMEDY 3: Clean the picture tube. This is the most obvious but is often overlooked. (It has been estimated that in a typical industrial city enough soot can be collected in 6 months *or less* to reduce the brightness by more than 50 per-cent!). Use mild soap and water, or regular glass cleaner. Clean the rubber mask with carbon tetrachloride.

Fig. 2. Neck shadow or rounded corners, as shown here, require that the focus and deflection coils must be checked once again.

Fig. 3. Condition such as this indicates a weak or low emission tube. Correcting this fault requires the use of a new picture tube.

Fig. 4. Grid-cathode or heater-cathode short in TV picture tube may produce this extremely "contrasty" effect.

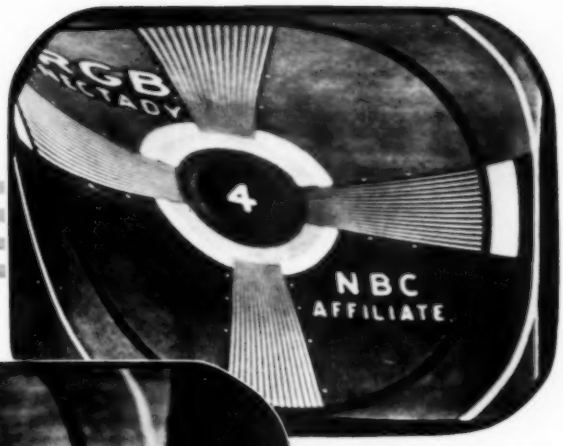


Fig. 5. If a metal-cone picture tube has been magnetized, a condition such as shown here results. The tube must be demagnetized. See text for instructions.

Fig. 6. Another case of metal-cone tube magnetization. The servicing procedure outlined for Fig. 5 applies in this case.

Fig. 7. Hum in picture causes curved or distorted raster edges as shown here and in Fig. 8. Try replacing the TV picture tube.

Fig. 8. Another example of hum in the picture tube. Replace the tube first before checking the power supplies.

Fig. 9. When the picture inverts or goes negative when brightness control is advanced, several tubes must be checked. In this illustration the picture is on the verge of inverting. See text for method of correction.

2. *DEFECT: "Blooming"; increase in picture size, loss of focus when brightness is increased.*

CAUSES: Defective second anode resistor; weak high-voltage rectifier; defective horizontal output transformer, or other high-voltage troubles. Very seldom is the picture tube at fault in this instance.

REMEDY: Check out the high-voltage supply as usual. Particularly, replace the second anode resistor.

3. *DEFECT: Flicker; varying brightness, or intermittent picture (raster may or may not disappear).*

CAUSE 1: Intermittent or poorly-soldered connections on the picture tube socket or base pins.

REMEDY: Sweat out the old solder and resolder all base pins and socket connections. Use a very hot iron and a good grade of solder.

CAUSE 2: Intermittent grid-cathode or cathode-heater leakage or short.

REMEDY: Substitute a new tube. If leakage or short is indicated, use one of the methods described under Defect No. 5.

4. *DEFECT: Ion Spot.*

CAUSE: Incorrectly-adjusted ion trap (allows heavy ions to bombard screen in concentrated force).

REMEDY: If the picture tube is covered in the customer's warranty, contact his dealer or distributor for adjustment. (Customers should be advised to call you or their dealer the moment a discoloration or ion burn appears.) An ion trap adjustment may keep the spot from spreading, even if the tube is out of warranty and replacement is not desired immediately.

Note 1: On some receivers, the beam will remain in a concentrated spot for some time after the set has been turned off. On tubes like the 16JP4, this may eventually discolor or burn the screen. Advise your customer (if this occurs) to turn the brightness *full on* immediately after the set has been turned off. (This aids in draining the charge off the high-voltage condensers.) If this trouble is too serious, you might try a non-inductive bleeder resistor (2 megohms or higher) across the high-voltage output filter condenser. (*Continued on page* 125)

ELECTRONIC GROWTH in the PACIFIC SOUTHWEST

New store of Radio Specialties Company showing center island sample boards, RCA murals above test equipment displays, and the indirect lighting fixtures in the center of island displays.

By

S. K. PAINTER

Pres., Radio Specialties Co., Los Angeles

The meteoric rise of the Pacific Southwest as an electronics center has stimulated the growth of specialized distributor warehouses and stores.

THE growth of electronics in the Pacific Southwest has been at a faster rate than in any other section of the country. When the West Coast Electronics Manufacturers' Association was founded in 1943, the area was producing electronic equipment at the rate of approximately $25,000,000 a year. Production increased ten-fold by the end of World War II and is currently at the rate of a half-billion dollars a year.

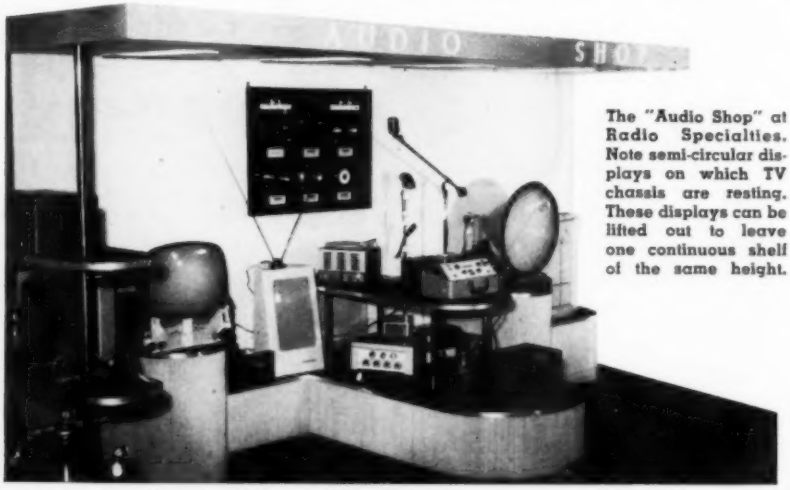
According to a survey made by the Department of Labor, there are more people employed in military and commercial electronics manufacturing in the Los Angeles area than there are in Chicago. A recent report by the U. S. Navy estimated that approximately 50,000 persons are employed in Southern California by electronic prime contractors and component manufacturers. More than 6,700,000 square feet is devoted to electronic work alone.

California has been important in the research and development of radio and other electronic applications ever since the birth of "wireless." Its many engineering schools, such as Cal-Tech, Stanford, California, UCLA, and USC, have been leaders in electronic research. The radio handbooks of F. E. Terman of Stanford University are used throughout the world. Even the first regular telecasts in the U. S. originated from Los Angeles, *circa* 1931, when programs were scheduled one hour per day, six days a week.

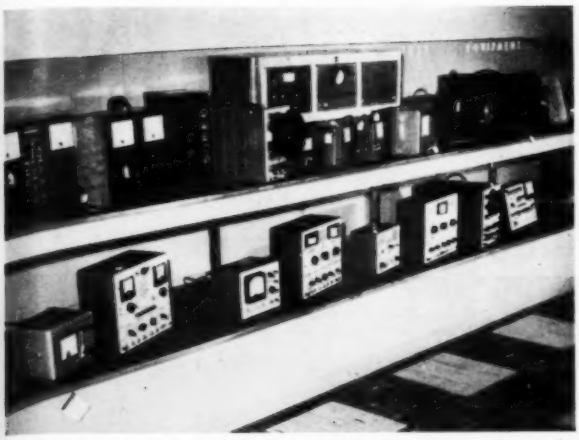
With motion picture studios concentrated in Southern California, it was to be expected that some of the finest sound research would originate and audio equipment would be developed in this area. Moreover, an entertainment center so important could not help but create a need for outstanding recording studios and television program sources.

With the advent of commercial telecasting, many predicted that motion picture studios would soon be out of business. It is interesting to note, therefore, that more films are now made for television than are made for theater viewing. Many of the smaller motion picture studios devote their entire facilities to the production of kinescoped programs which are shipped throughout the world.

The number of television transmitters in Los Angeles is the same as for the combined New York-New Jersey metropolitan area and considerably more than those of any other centralized location. Seven transmitters are located a short distance from Los Angeles on Mt. Wilson (at an elevation of approximately 6000 feet). This excellent location permits the transmitting of a signal which is picked up reg-



The "Audio Shop" at Radio Specialties. Note semi-circular displays on which TV chassis are resting. These displays can be lifted out to leave one continuous shelf of the same height.



The test equipment display. The molding along the back drop has electrical outlets spaced at intervals of 12 inches.

Close-up of one of center island display boards with its glass covered samples. Record changer display is shown in background.

ularly in fringe areas as far away as 225 miles.

The importance of the television receiving field in the Los Angeles area is attested by its rating as second in the nation, New York City being the only area with a greater number of sets in use. On May 1, 1952, according to the Electric League, there were 1,252,184 television receivers in the Los Angeles signal area, or 7.5 per-cent of the total number in the United States. In the calendar year 1951, 437,172 sets or 8.6 per-cent of the U. S. total were shipped to California. These sets were handled by the approximately 1800 television retail stores in addition to the other outlets which retailed TV in addition to other merchandise.

To electronics, as found in other metropolitan centers, is added the fast-growing aircraft industry. California had 32 per-cent of the total employment of the U. S. aircraft industry by the end of 1951. Aircraft and allied activities currently involve more than 185,000 persons in California, an increase of 110 per-cent over the pre-Korea level.

The aircraft industry has become more and more closely associated with electronics. A number of aircraft and air parts firms now are concerned almost exclusively with the electronics involved in guided missiles, radar, and communications equipment.

Major prime military awards to California in the fiscal year ended June 30, 1951, amounted to $3,899,450,000 or 13.2 per-cent of the total for the United States. California had the second largest total for any state. The importance of aircraft in the Southern California industrial picture is evidenced by the fact that aircraft accounts for 27.6 per-cent of all manufacturing employment in Los Angeles.

The exceptional diversity of electronics in the Los Angeles area has given rise to a new local industry of electronic parts manufacturers; fabricators of antennas, masts, lead-in wire, and other accessories; television installation firms; and radio and television schools. More and more Eastern manufacturers, taking note of the growth of demand and of the local firms which have sprung up to meet this need, have met the new competition by establishing Los Angeles warehouses to service their distributors and manufacturing customers more quickly.

To help meet the demand for an on-the-spot source of supply, *Radio Specialties Company*, a twenty-year-old electronics parts distributing company, has recently opened a unique type of wholesale display store and enlarged and redesigned parts warehousing facilities.

Probably the most unusual feature of this new outlet is that it is a parts store without an apparent small parts stock and that with its contemporary design has a singularly uncluttered look. There is only one sample each of the basic small parts in each line on display. These items are shown on sample boards with the warehouse stock accessible but out-of-sight.

As one of the largest distributors of *RCA* industrial tubes in the nation, *Radio Specialties Company* has long supplied a large part of the replacement needs of the television and broad-

(*Continued on page* 122)

Sample boards act as facades for the stock bins behind counter. These boards, which are indirectly lighted for easy parts selection, help hide the warehoused stock while selling parts.

Wall-type sample boards and the record player-changer display. Construction is of combed plywood in a "free form" design.

The R.C.O.—A Remote Control Oscillator

By
JOHN F. CLEMENS
W9ERN

Over-all view of exciter and control box. The tiny frequency control box (right) may be installed remote from the oscillator and exciter unit shown at the left.

Details on a unit which permits the transmitter frequency to be varied by means of a compact control box which is connected to the oscillator tube through coaxial cables.

THE variable frequency oscillator is becoming increasingly popular among mobile station operators. To obtain the full benefit of the v.f.o. the frequency control dial must be located in such a way so as to permit convenient manipulation by the driver. At the same time, most mobile transmitters are located in the trunk compartment where the equipment may be easily mounted and at the same time not snag the XYL's stockings.

Various stratagems have been employed in separating the v.f.o. and the remaining stages of the transmitter or mechanical remote control devices have been devised. Very often the resulting layout is a disheartening array of interconnecting cables and complex coupling circuits.

A new circuit, originated for remote control of an oscillator, promises a number of advantages. The control box itself need be only large enough to house the oscillator coil and tuning condenser so that under-dash mounting of the control is no problem. The frequency control circuits could be easily installed in the regular switch control box found in most mobile installations. The heat generating elements, tubes and resistors, are completely isolated from the frequency control box so that frequency stability is not affected by temperature changes in the transmitter. Only two coax cables connect between the control box and the transmitter and the length of the interconnecting cable is not critical.

The remote control oscillator or r.c.o. is designed around the very popular series-tuned oscillator circuit. This circuit is characterized by a high degree of isolation between the oscillator tube and the oscillator tank circuit. This isolation is achieved by the relatively large bypass capacities shunting the grid-cathode and plate-cathode circuits. This capacity is not critical, having only second order effects on the oscillator frequency, the usual design criterion being that the capacity should be as large as possible up to the limiting point where the circuit ceases to oscillate, although good stability is obtainable well before reaching this limit.

In the most popular version of the series-tuned oscillator, the plate, or screen, if a pentode is used, is operated at ground potential. This connection places the cathode and common junction of the large shunt capacities at a potential above ground for r.f. In developing the r.c.o. circuit, the ground point has been moved to the cathode of the tube. This means that one terminal of each of the large shunt capacities is grounded. It is now a simple step to substitute a length of coaxial cable for each of the bypass condensers, utilizing the internal capacitance of the cable. The capacity of 50-ohm cable is approximately 28 $\mu\mu$fd. per foot so that in a length of cable suitable for connection between the dashboard and the trunk compartment, a shunt capacity is obtained which is adequate for operation of the oscillator in the 7 mc. band. On the lower frequency bands additional fixed capacity may be shunted across each cable or the cable length may be extended. At 7 mc. the cables are still electrically "short," meaning that the capacity can be considered as lumped and the inductance of the cable may be disregarded.

The benefit of grounding the common junction of the bypass condensers is now evident since the shield of each cable is at ground potential. The cables may be moved about freely, either together or separately, without affecting the oscillator frequency.

An experimental transmitter r.f. section incorporating the r.c.o. is shown in the photographs. This unit was constructed to test the workability of the r.c.o. idea and is not necessarily recommended as the optimum layout, although circuit elements have been varied to obtain the best operating conditions.

A 6AG5 is used as a pentode oscillator-doubler. A 6J6 was first tested in the circuit, using the first triode section as oscillator and the second section as frequency doubler. It was found that the 6AG5 was considerably more efficient than the 6J6 and since an interstage coupling resistor and condenser are not necessary in the 6AG5 due to the electron coupling, the pentode circuit has more advantages.

A second 6AG5 was chosen as the second doubler to 28 mc. after comparison with a 6C4 and one-half of a 6J6 showed the superiority of the 6AG5. The 14 mc. plate tank of the oscillator and the 28 mc. tank of the multiplier are both broadband circuits with very

low tuning capacity, using slug-tuned coils.

The 2E26 stage is incomplete as shown since the plate circuit is mounted on a separate sub-chassis with the output coupling circuit. The rectified grid current of the 2E26 has been used as a criterion of oscillator and doubler performance throughout the tests.

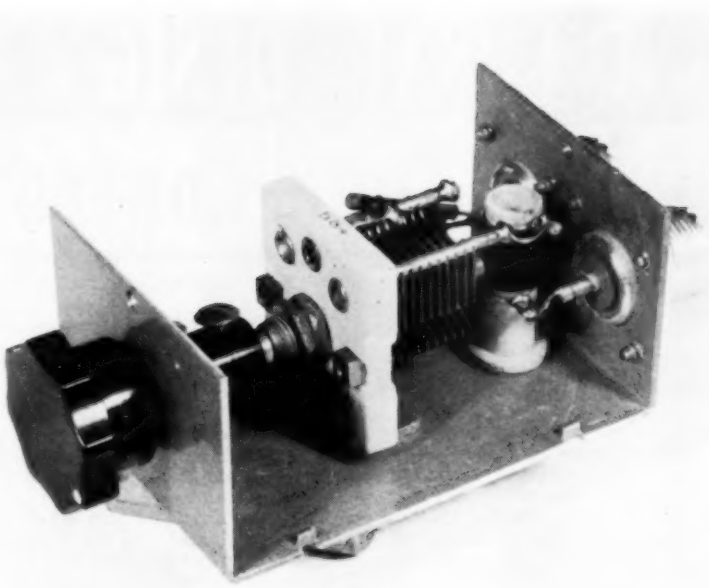
With a plate voltage of 275 on the circuit, grid current to the 2E26 was 5 ma. maximum with both 6AG5 plate tanks peaked at 29 mc. The grid current did not drop below 4 ma. when the r.c.o. was tuned over the entire 28 mc. phone band, 28.5-29.7 mc. Total plate and screen current to the two 6AG5's was 26 ma. at 29 mc., rising to 28 ma. at both ends of the tuning range. Although some decrease in the 2E26 grid current is to be expected when plate voltage is applied, the grid current obtained is almost twice the rated requirements, so that adequate excitation is assured.

The tuning condenser shown in the development model has a capacity of 50 $\mu\mu$fd. which is larger than necessary to cover the 28 mc. phone band. A 15 $\mu\mu$fd. variable condenser, shunted by a 30 $\mu\mu$fd. fixed ceramic condenser, will bandspread the 28 mc. phone band over the entire scale. The slug-tuned oscillator grid coil may be adjusted to the proper frequency after the control box is installed. The shaft of the tuning condenser is not grounded and an insulated shaft coupling must therefore be used. The rotor of the tuning condenser should be connected to the lead to the coax center conductor rather than the junction of coil and condenser, since the former is at a lower r.f. potential. A double-bearing tuning condenser is highly recommended for greatest mechanical stability.

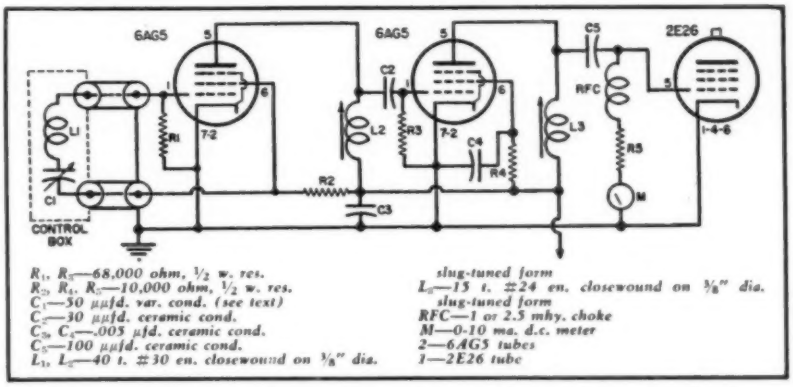
The interconnecting cables used in obtaining all the above data were each ten feet long. RG-29/U, 50-ohm cable was used. Cable lengths up to 13 feet were tested with similar results. If longer lengths are required, a 72-ohm coax cable may be used since its capacity per foot is lower. Operation with cable lengths up to 20 feet with the oscillator on 7 mc. should be possible with 72-ohm cable. On lower frequencies the cables may be proportionately longer. As a general rule, the capacity shunting each cable circuit should be approximately 300 $\mu\mu$fd. at 7 mc., twice this value at 3.5 mc., etc. For very short cables having insufficient internal capacity, the difference may be made up with fixed condensers shunted across the cable circuits.

Another obvious application of the r.c.o. is frequency control of a rack-mounted transmitter and v.f.o. from an operating table. The elimination of frequency drift troubles due to the absence of heat in the tuned circuit compartment, plus the compactness and simplicity of the control unit make this system attractive.

-30-



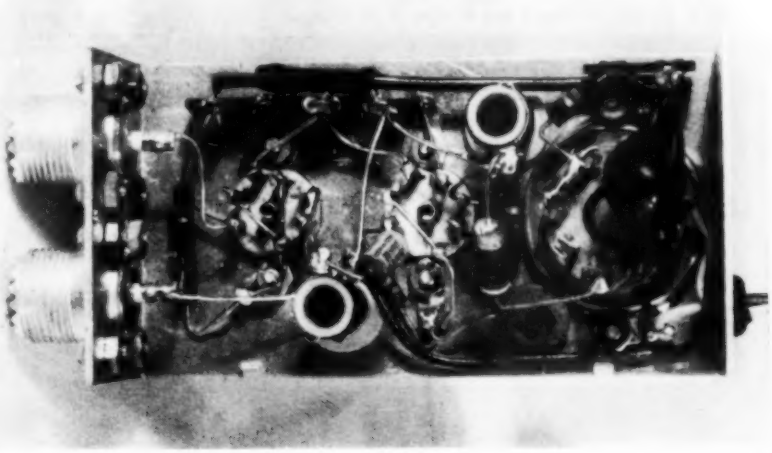
Frequency control box contains just a series coil and condenser tuning circuit.



R_1, R_2—68,000 ohm, ½ w. res.
R_3, R_4, R_5—10,000 ohm, ½ w. res.
C_1—30 $\mu\mu$fd. var. cond. (see text)
C_2—30 $\mu\mu$fd. ceramic cond.
C_3, C_4—.005 μfd. ceramic cond.
C_5—100 $\mu\mu$fd. ceramic cond.
L_1, L_2—40 t. #30 en. closewound on ⅛" dia. slug-tuned form
L_3—15 t. #24 en. closewound on ⅛" dia. slug-tuned form
RFC—1 or 2.5 mhy. choke
M—0-10 ma. d.c. meter
2—6AG5 tubes
1—2E26 tube

Diagram of remote control exciter. The "B+" supply (indicated by arrow at right of diagram) is 275 volts which is obtained from the transmitter's power supply.

Underchassis view of exciter oscillator. Shielding and heat isolation difficulties are eliminated since frequency control elements are physically separated.



UNIVERSAL DESIGN CURVES for Tone-Control Circuits

By
M. B. KNIGHT
RCA Victor Division
Harrison, N. J.

Part 2. Design data on two circuits which may be used to provide variable bass tone control.

THIS is the second article in the current series on practical *RC* tone-control circuits. These articles describe simple circuit arrangements suitable for particular types of tone control and include frequency-response curves obtained with each circuit. The curves permit rapid evaluation of the ability of a circuit to fulfill specific design requirements. They also indicate the preferred potentiometer taper and facilitate the choice of component values.

The first article of this series and the author's article in the November 1951 issue presented universal design curves for three treble tone-control circuits which are also useful for fixed bass compensation. This article will cover two circuits designed for variable bass tone control.

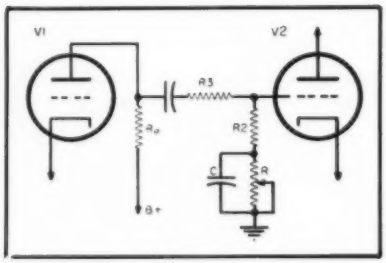


Fig. 1. Circuit for providing variable bass boosting. Fig. 2 is the equivalent circuit.

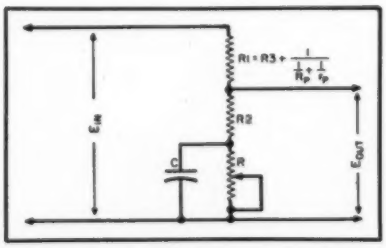


Fig. 2. The equivalent circuit for Fig. 1.

Variable Bass-Boosting Circuit

A circuit which will accomplish variable bass boosting is shown in Fig. 1 and the equivalent circuit used for analysis is shown in Fig. 2. In many designs, the resistor R_3 will be so large compared to the source impedance of the tube and its plate load resistor $1/(1/r_p+1/R_p)$ that, for practical purposes, the resistance R_1 may be considered to be equal to R_3. This relationship will usually be true if the tube V_1 is a medium-mu triode. If V_1 is a pentode, its plate resistance, r_p, is so high compared to the plate load resistor, R_p, that r_p may be neglected, but R_p will not usually be negligible and R_1 will equal R_3 plus R_p.

There are two advantages in making R_2 and R_3 relatively large in value. First, a smaller coupling condenser is required for good low-frequency response. Second, the danger of distortion in V_1 because of small load impedance is avoided. On the other hand, R_2 cannot be excessively large, or the value of the potentiometer R becomes impractically large.

The universal design curves for this circuit are shown in Figs. 3, 5, 6, and 9. The zero db reference level represents the output at frequencies high enough so that the output is unaffected by the adjustment of the tone control. As was mentioned in the November 1951 article, a boosting circuit should not be designed for more boost than is required because the boost is obtained at the expense of gain. The loss of gain for the middle and high frequencies caused by this circuit may be determined from the curves and is equal to the highest value of boost on the curves when R equals infinity.

As an example of the use of these curves, let us set up some design objectives and see if we can meet them. Suppose we would like to use a triode for V_1 and want as much gain from the amplifier stage as can be reasonably obtained. We shall seek a tone control capable of about 15 db of boost so that 3 db of boost occurs at 500 cycles. The curves of Fig. 6 show that 15 db of boost can be obtained with a ratio of R_1/R_2 equal to 5. In the interest of obtaining the maximum possible gain from the amplifier, the potentiometer should be as large as practicable, say one megohm. Next, the value of R_2 may be determined. Examination of the curves reveals that

Fig. 3. Curves for Figs. 2 and 4 when R_1/R_2 is equal to 1.

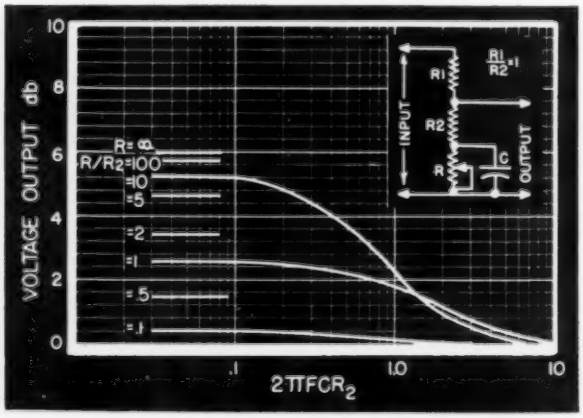
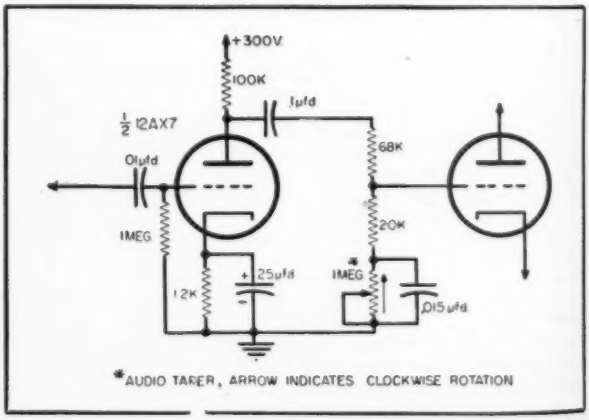


Fig. 4. Bass boost circuit which gives 14 db at 50 cps.



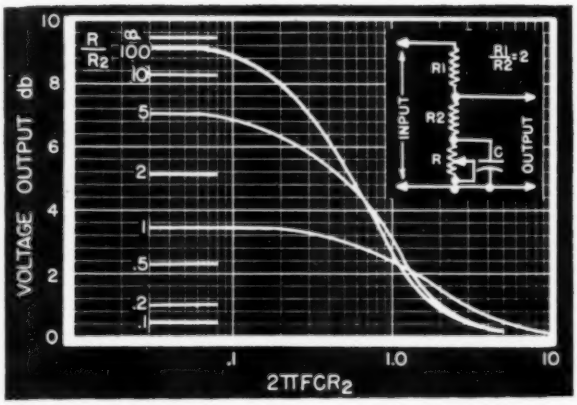


Fig. 5. Curves for Figs. 2 and 4 when R_1/R_2 is equal to 2.

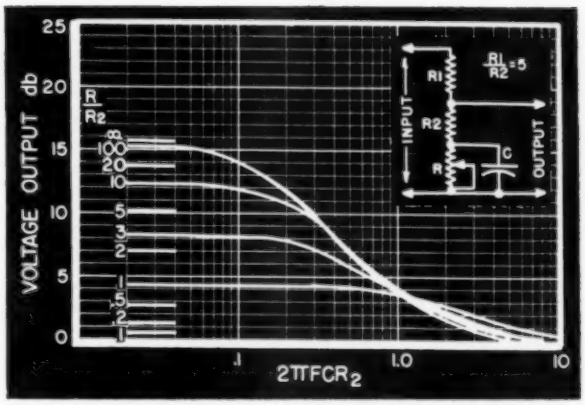


Fig. 6. Curves for Figs. 2 and 4 when R_1/R_2 is equal to 5.

slightly more than 15 db boost can be obtained with the ratio of R/R_2 equal to 100. If the ratio is 50, however, only about one-half db of boost is sacrificed, and we shall see that it is easier to obtain the desired gain if the values of R_1 and R_2 are made as large as possible. Using the ratio of R/R_2 equal to 50, the value of R_2 will be 20,000 ohms. Then, because the ratio of R_1/R_2 is 5, the value of R_1 is 100,000 ohms. Now the choice of a tube for V_1 can be made. We would expect to obtain the most gain from a high-mu triode, so let us select one section of a 12AX7 and use the circuit values from the "Resistance-Coupled Amplifier Charts" found in tube handbooks. The value of the grid resistor R_g to be used with these charts is equal to the impedance of the tone-control network at high frequencies (or with R adjusted to zero). Using the constants selected above, this value of impedance is approximately 100,000 ohms. Examination of the "Resistance-Coupled Amplifier Charts" shows that 100,000 ohms is a good choice for the plate load resistor, R_p. The cathode resistor, R_k, should be 1200 ohms, the nearest RTMA value to the value of 1300 ohms given in the chart. The mu of the tube, obtained from the tube data, is 100. In order to determine the value of R_2 we must find the equivalent source impedance of the tube and its plate load resistor, $1/(1/r_p+1/R_p)$. To find this impedance, we first calculate R_o, the effective parallel value of the grid resistor, R_g, the plate load resistor, R_p, and the plate resistance, r_p, of the tube. As stated in the previous articles, we have found a formula which may be used to calculate R_o directly with fair accuracy. It should be remembered that this formula is empirical and applies only to triodes operated in accordance with the values given in the "Resistance-Coupled Amplifier Charts."

$$R_o = .17\ \mu\ R_k + 5000 \text{ (ohms)}$$
$$= .17\ (100)\ (1300) + 5000$$
$$R_o = 27{,}100 \text{ ohms}$$

Then, using the formula for R_o,

$$R_o = \frac{1}{\frac{1}{r_p} + \frac{1}{R_p} + \frac{1}{R_g}}$$

We can rearrange the terms to solve for the source impedance of the tube and its plate load resistor.

$$\frac{1}{\frac{1}{r_p} + \frac{1}{R_p}} = \frac{1}{\frac{1}{R_o} - \frac{1}{R_g}}$$
$$= \frac{1}{\frac{1}{27{,}100} - \frac{1}{10^5}}$$

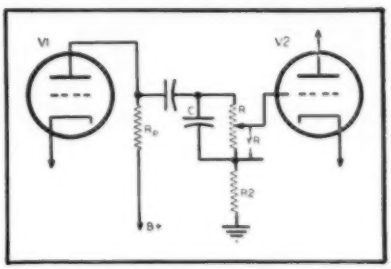


Fig. 7. Circuit for variable bass attenuation.

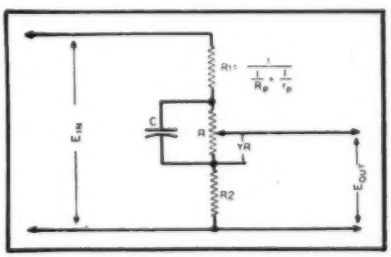


Fig. 8. The equivalent circuit for Fig. 7 assuming the same value of impedance.

$$= \frac{1}{2.69 \times 10^{-5}} = 37{,}000 \text{ ohms}$$

The value for R_2 is R_1 minus the source impedance value determined by the

(*Continued on page* 93)

Fig. 9. Curves for Figs. 2 and 4 when R_1/R_2 is equal to 10.

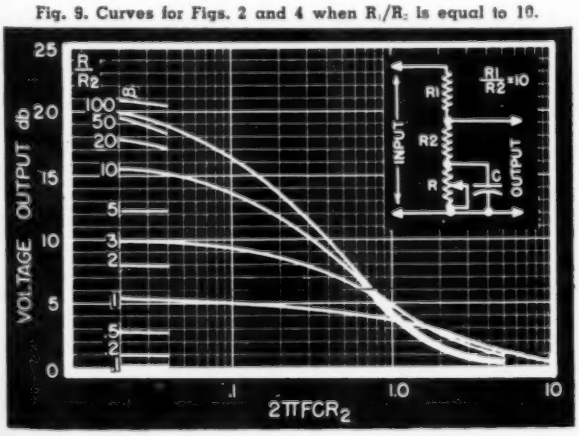
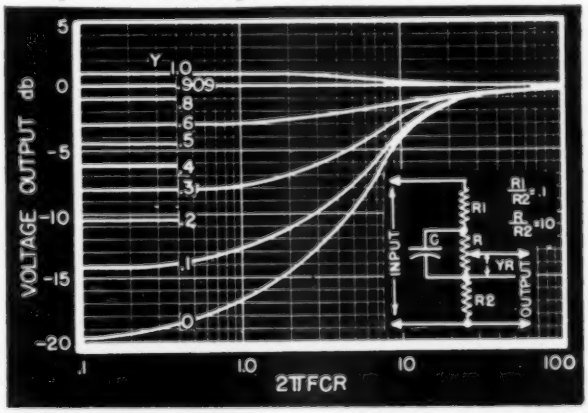


Fig. 10. Curves for Figs. 7 and 8 for two circuit values.



The MULTI-SIGNAL GENERATOR

By
LOUIS E. GARNER, JR.

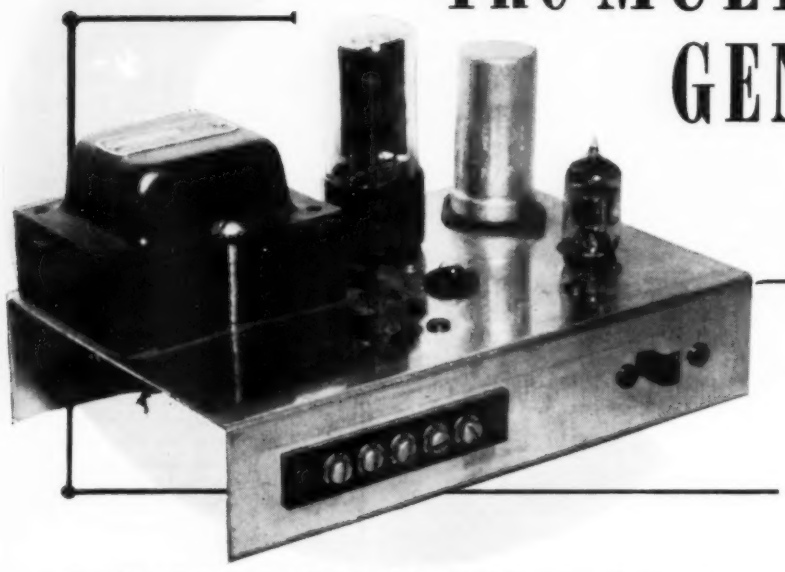


Fig. 1. Over-all view of the "Multi-Signal Generator." The entire unit measures 7½" x 5" but provides 60-cycle sine-wave, saw-tooth, and square-wave signals.

Construction details on a combination power supply, square-wave and saw-tooth generator for home use.

TEACHERS, lab technicians, and home experimenters often need a d.c. and filament power source to supply experimental circuits. This need is generally met by having a small power supply chassis available. In addition, however, the experimenter often requires a signal of a particular waveshape, either to check the operation of a circuit, or to check the response of a filter or attenuator circuit to signals other than sine waves. Where the need is a continuing one, or the financial resources of the experimenter large, this need can be filled by appropriate special signal generators.

On the other hand, where the need for special signal waveshapes is not continuous, an ordinary power supply chassis may be modified, by adding only a few readily available parts, to supply a square-wave signal, a saw-tooth signal, and a sine-wave signal, in addition to acting as a source of d.c. voltage.

The small chassis shown in Fig. 1 (only 7½" x 5") supplies "B plus" (350 volts at 40 ma.), a 60-cycle sine-wave signal (which may also be used as a 6.3 volt, 2.5 amp. filament supply), a 60-cycle square-wave signal, and a 60-cycle saw-tooth signal. The cost of the additional parts necessary to supply these special signal waveshapes over the cost of the power supply components alone was less than two dollars. Only about an hour's additional wiring time was required.

Where the builder does not wish to assemble a special chassis, the additional parts needed can generally be fitted easily on any available power supply chassis.

Circuit Description

Reference to the schematic diagram of Fig. 2 shows that a conventional d.c. power supply circuit is employed. V_1 is connected as a full-wave rectifier, with filtering provided by choke CH_1 and electrolytic filter condensers C_2 and C_3. Bleeder resistor R_1 provides a slight degree of voltage regulation.

The 6.3 volt winding of the power transformer is used to supply filament voltage to the clipper tube, V_3, and also acts as the sine-wave signal source. Since the filament current requirements of V_2 are small, this winding may also serve to supply filament voltage to external circuits.

A neon-bulb relaxation oscillator is used to supply a saw-tooth signal. Condenser C_4 is charged slowly through resistor R_3. As soon as the charge across C_4 reaches the firing potential of V_2 (a neon bulb), the gas in this tube ionizes and acts as a practical short-circuit across C_4, discharging this condenser until the voltage is no longer sufficient to sustain ionization. V_2 then stops conducting and C_4 starts to charge again, with the action repeating itself at a rate dependent upon the supply voltage and upon the time-constant of R_3-C_4. By making R_3 variable, the output frequency of the saw-tooth signal may be varied to suit the individual experimenter.

C_5 acts as a blocking condenser to eliminate the d.c. component of the saw-tooth signal appearing across C_4. Thus, only a pure saw-tooth is available at the output terminal of the chassis.

To obtain a 60-cycle square-wave signal, a portion of the voltage available across one-half of the high-voltage secondary winding is applied through coupling condenser C_1 to a series-diode clipper circuit. C_1 and R_4 act as a voltage divider to reduce this high voltage slightly. At the same time, however, R_4 acts as part of the clipper circuit.

The series diode clipper has been previously described by the author (RADIO & TELEVISION NEWS, March, 1950, "Wide Frequency Range Square-Wave Clipper") but a brief review of its operation may be appropriate here.

The flashlight cell, E, acts to place a small bias on the cathodes of the dual-diode tube, V_{3a}, so that this tube is normally conducting. As long as the amplitude of any applied signal does not exceed the battery voltage, the diode acts simply as a closed circuit, permitting any signal appearing across R_4 to appear, without modification, across R_5.

When the negative peak of the applied signal is sufficient to drive the plate of the left-hand diode section negative with respect to its cathode, this half of the tube stops conducting and acts as an open circuit, thus clipping the remainder of the negative peak.

Similarly, when the positive peak of the applied signal is sufficient to make the cathode of the right-hand diode section positive with respect to its plate, this half of the tube stops conducting and acts as an open circuit, clipping the remainder of the positive peak.

Either condition will occur when the applied signal exceeds the voltage of battery E.

Since the sine-wave signal applied through C_1 greatly exceeds the battery voltage, excellent clipping is obtained and an almost perfect square wave appears across R_5.

The entire chassis thus serves to supply, simultaneously, a "B" voltage, a square-wave signal (Fig. 3A), a sine-wave signal (Fig. 3B), and a saw-tooth signal (Fig. 3C).

Since r.f. or other high frequency signals are not present in the circuit, wiring and layout is not at all critical. It is only necessary to take reasonable care and follow conventional wiring techniques.

A word of caution, however. The battery should either be mounted below chassis or, if mounted above chassis, should be located well away from the rectifier tube and power transformer. This is to insure that the heat of these two components will not adversely affect the life of the flashlight cell.

Parts values are not at all critical and considerable variation from the values given in the parts list are permissible. This is especially true as far as the power supply components are concerned. A much heavier power transformer may be used; almost any suitable rectifier tube may be employed for V_1; a much larger filter choke or filter condensers may be substituted. In fact, if the builder prefers, the simple power supply circuit shown may be replaced with a complex voltage-regulated circuit, incorporating regulator and control tubes as well as the rectifier.

V_2 may be either an NE-2 or an NE-51. Other neon bulbs may be substituted by varying the sizes of R_3 and C_4.

The 6AL5 used for V_3 may be replaced, without circuit modification, by a twin-triode tube, diode connected (grids and cathodes tied together), or by other twin-diode tubes, such as the 6H6.

If a square-wave signal of greater amplitude is desired, substitute a 4½ volt bias battery for E. If a control over amplitude is desired, use a 50,000 ohm pot. in place of R_5.

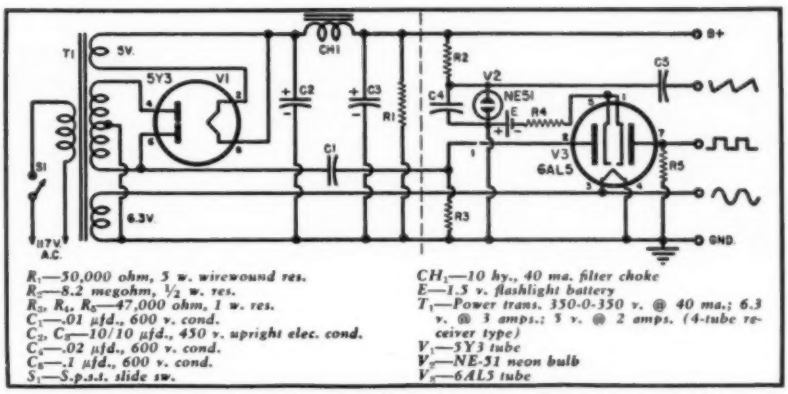
As can be seen by reference to the under-chassis view (Fig. 4), the additional parts required occupy very little space, even on the small chassis used by the author. Where space is at a premium, however, these components may be mounted in a small metal utility box, which, in turn, may be connected to the power supply chassis through a multi-conductor cable.

Except for C_1, all the special parts required are shown to the right of the dotted line in Fig. 2.

The applications of the "Multi-Signal Generator" are many and varied, but a detailed listing would be out of place here. Each experimenter or reader can best tell, from his own experience, where such a piece of equipment would fit in his home or shop laboratory.

Several important points should be remembered when connecting this piece of equipment to other apparatus for tests, however.

First, the saw-tooth signal source is a high-impedance source. Thus, if loaded too greatly, the waveshape and amplitude may suffer considerably. Where it is mandatory that the output saw-tooth signal be used in a low-impedance circuit, interpose a simple buffer amplifier between the saw-tooth output terminal of this unit and the test circuit. If desired, this amplifier may be powered by the "Multi-Signal Generator" itself.



R_1—50,000 ohm, 5 w. wirewound res.
R_2—8.2 megohm, ½ w. res.
R_3, R_4, R_5—47,000 ohm, 1 w. res.
C_1—.01 μfd., 600 v. cond.
C_2, C_3—10/10 μfd., 450 v. upright elec. cond.
C_4—.02 μfd., 600 v. cond.
C_5—.1 μfd., 600 v. cond.
S_1—S.p.s.t. slide sw.
CH_1—10 hy., 40 ma. filter choke
E—1.5 v. flashlight battery
T_1—Power trans. 350-0-350 v. @ 40 ma.; 6.3 v. @ 3 amps.; 5 v. @ 2 amps. (4-tube receiver type)
V_1—5Y3 tube
V_2—NE-51 neon bulb
V_3—6AL5 tube

Fig. 2. Circuit diagram of the "Multi-Signal Generator." Except for C_1, all the special parts required are shown to the right of the dotted line in the schematic.

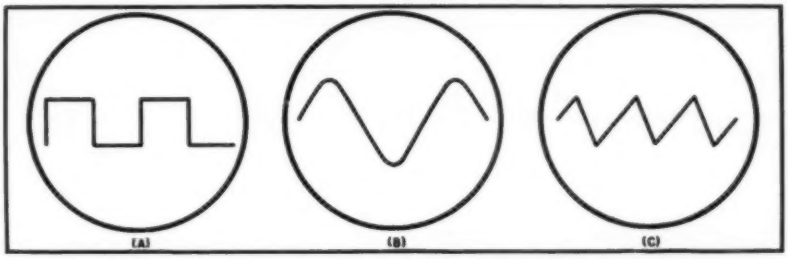
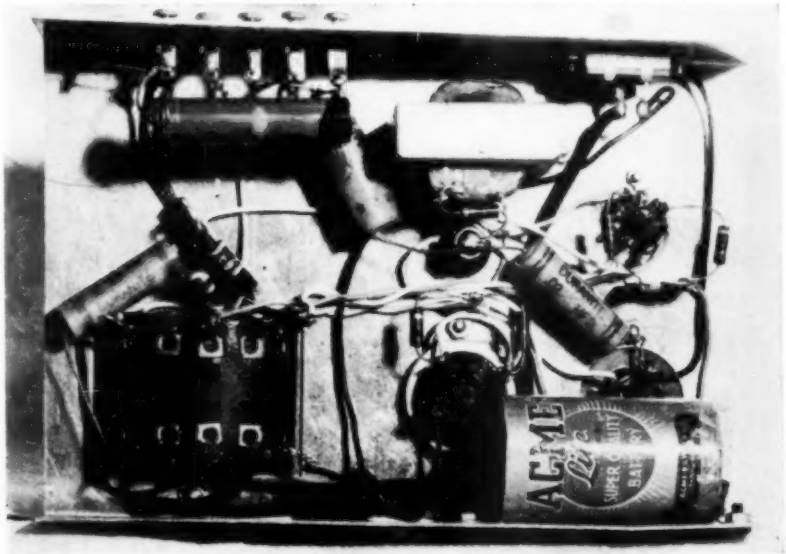


Fig. 3. Output of unit. (A) square-wave, (B) sine-wave, and (C) saw-tooth signals.

Secondly, a d.c. component appears with the square-wave signal across R_5. While this component is small in amplitude, it may cause trouble if an attempt is made to connect the square-wave output terminal directly to the grid of an amplifier tube. Thus, when d.c. cannot be tolerated in the experimental circuit, connect an ordinary paper condenser between the square-wave output terminal and the experimental circuit. The size to use will be determined by the impedance of the circuit to which the square-wave signal is applied. For high impedance circuits, a .5 μfd. condenser will generally give satisfactory results. For low impedance circuits, it may prove necessary to go to 2 μfd. or even higher if good waveshape is to be preserved.

These limitations are not serious, of course, and do not affect the operation of the "Multi-Signal Generator" in most of its applications. —30—

Fig. 4. Under chassis view of the "Multi-Signal Generator" showing parts layout.



CINEMAGNETIC RECORDING

By
A. C. BLANEY
Manager, Film Recording Engr.
Radio Corporation of America

Fig. 1. The mixer amplifier which is part of RCA's PM-64 sound recording system for movie work.

New tape techniques, adapted to movie work, presage substantial savings and efficient film processing for Hollywood studios.

A NEW and useful tool for making motion pictures was first publicly presented to the film industry in May, 1948 by the *Radio Corporation of America* at the Society of Motion Picture and Television Engineers' convention in Santa Monica. This new tool was magnetic sound recording. The art of magnetic recording had shown steady improvement for more than a decade. Recording on ¼ inch magnetic tape and wire had advanced to a degree which permitted its use in many commercial applications. All of these previous methods, however, did not provide the exact synchronism required by the motion picture industry.

While there was no question regarding the quality that could be obtained by recording on magnetic materials, *RCA* film recording engineers realized through their close association with Hollywood that many practical problems would develop in the operation of this new tool. It was therefore decided to explore this new medium by first adapting photographic recorders, then in operation, to handle the perforated magnetic film. This gave the film industry the opportunity to experiment with the new medium with a minimum investment in equipment. In retrospect, this proved to be a wise and conservative decision.

Although it was realized from the first that magnetic recording would enable motion picture producers to extend the volume range and the frequency range of their original sound recordings, it was necessary that the new sound recording technique show other advantages. Photographic recording had served the film industry quite well for many years.

Those who were willing to experiment soon found that magnetic recording could be made to pay dividends. First, the greater volume range of the magnetic film was found to be quite useful in the original recordings where wide variations in sound level exist. Quite often a recording was found to be entirely satisfactory when recorded on magnetic film although when recorded on photographic film the level proved to be too low and therefore too close to the noise level. The photographic films depended upon the transmission of light for the reproduction of sound and therefore were subject to noise due to handling which picks up dirt and causes scratches on the film. Magnetic films were found to be comparatively free from this type of problem.

Again, the handling of magnetic film could all be done in daylight which proved a distinct advantage for the operator. Still another advantage of the magnetic medium was that it could be played back concurrently with the recording and the operator was assured that he had a record of the sound. While it was possible to listen to the modulated light in the photographic process and gain some assurance that recording was satisfactory, still it was not as positive as playing back the signal from the film. All of these advantages added up to faster operation and more assurance that a satisfactory record had been made of the sound at the time the recording was made.

Here we may ask why the industry has not changed over more rapidly to use magnetic films for all of their

Fig. 2. The portable RCA sound recording system shown in use on movie location.

sound recording work. Aside from the resistance to changeover in equipment, the new recording technique does offer several new problems for solution. One of these is the problem of identification. Photographic films carry footage numbers and each "take" or scene is identified by some visible characters on the original negative. It follows, therefore, that any and all prints made from this original carry the same identification marks. At the present state of the art, copies of magnetic recordings must be made by the re-recording process. The identification must therefore be done manually which requires more time and expense.

Another rather serious problem with magnetic recording is that of editing. Film editors have been accustomed to working with visible soundtracks and depend on this extensively for accurate cutting. Magnetic soundtracks are not visible (although they can be made visible) and thus add to the time required by the editor to do his work. Splicing also has been a problem. Engineers and technicians in the film industry are finding ways and means of overcoming all of these problems and no doubt as the state of the art grows and there is time to develop the specialized equipment for handling magnetic film, this new medium will replace photographic recording at least up to the release negative point, with conventional photographic prints distributed to the exhibitors.

At the present time, Hollywood is making most original recordings on magnetic film. The "OK" magnetic takes are then re-recorded on a photographic track which is then edited in the conventional manner. In some cases the transfer is made to a direct positive which eliminates the necessity for a negative-to-positive printing operation. Some studios are using this process in conjunction with an anticipatory noise reduction system for which *RCA* recently won a citation from the Academy of Motion Picture Arts and Sciences. This system makes provision for minimizing the introduction of extraneous noise, thus achieving clearer and truer reproduction of speech, music, and other wanted sound.

Quite recently *RCA* has developed a new high-quality portable magnetic recorder-reproducer especially for original recordings whether in the studio or on location. This equipment is pictured on the front cover with Robert Mitchum as part of *RKO Radio's* location unit filming "The Lusty Men" in the ranch country north of Hollywood. The *Wald-Krasna Production* stars Susan Hayward, Mitchum, and Arthur Kennedy and was directed by Nicholas Ray. This sound system is expected to greatly change the recording picture and provide many studios with the means for low cost magnetic sound recording. This recorder handles 17½ mm. film at 45 feet-per-minute. This "half" speed provides ample frequency range for the motion picture industry with a safe margin, since 500 feet of film at 45 feet-per-minute in the sound recorder is equivalent in time to 1000 feet of picture film such as would normally be used in the motion picture camera. This reduction in speed has not only cut the film cost for the sound track in half but has also permitted the development of a smaller, more portable recorder. This is important where the equipment must be taken on location. The use of 17½ mm. film reduces film costs to approximately one-fourth of that required if the normal 35 mm. film were used at the normal speed of 90 feet-per-minute. Magnetic film has the further advantage that the soundtrack can be erased and used over again.

The complete *RCA* PM-64 sound recording system consists of a mixer amplifier, the recorder-reproducer, and the power supply. This equipment is

(*Continued on page* 116)

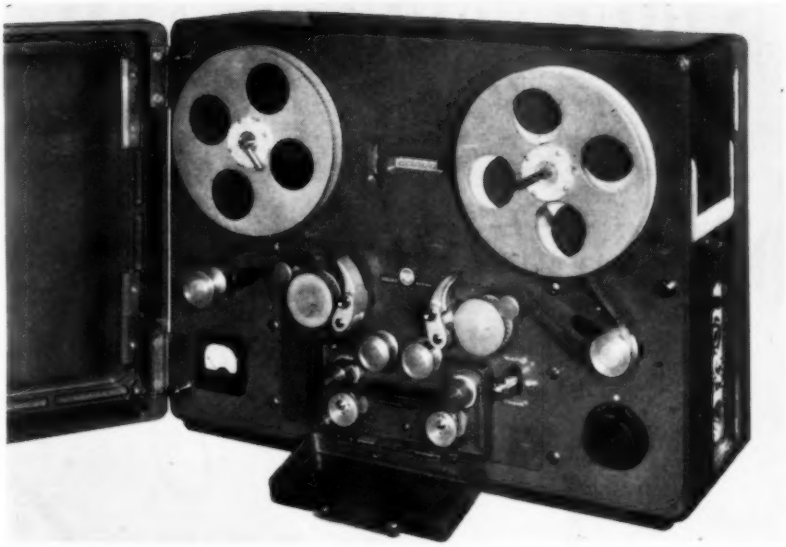
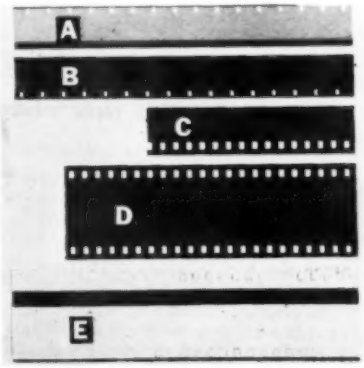
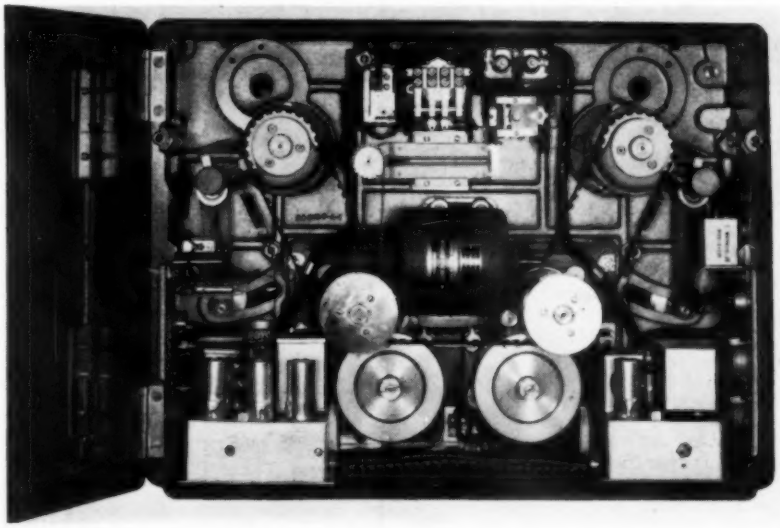


Fig. 3. Front view of RCA's Model PM-64 magnetic sound recording unit, with cover open.



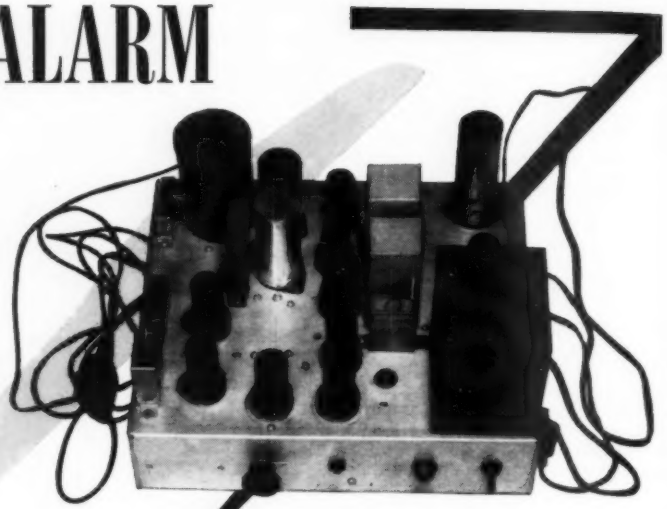
The five different magnetic tape types used for film recording. (A) 16 mm. striped magnetic—photographic raw stock; (B) 16 mm. full-coated; (C) 17½ mm. full-coated; (D) 35 mm. full-coated; and (E) 35 mm. striped.

Fig. 4. Rear view of the recorder with the door open to show component layout.



UNIQUE SOUND ALARM for DEAF PERSONS

By
H. G. DAVIS, JR., M.D.



Top chassis view of a practical signalling device for a deaf person.

Although designed to aid a deaf mother in caring for her child, this visual signal has many uses.

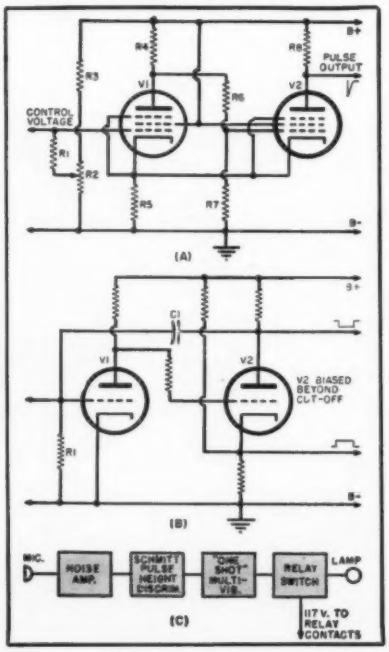
THE device to be described solved an interesting, but not unique problem. While it is simple in conception, certain definite limitations in operation and original cost made it difficult to execute. So it is thought that the special circuits utilized might warrant description for their individual usefulness, not limited to this single application.

The problem was to notify a deaf mother when her infant cried. The device had to be sensitive, relatively inexpensive, compact, and entirely automatic. Since the patient's hearing at the point of minimum loss (512 cps) was 90 db below normal, an ordinary amplifier and speaker would not work. Something to actuate a warning light had to be devised.

The simplest solution seemed to be a microphone pickup placed near the child, operating an ordinary speech amplifier, the output of which was rectified and used to cause conduction in a tube biased beyond plate-current cut-off, thus actuating a plate circuit relay. This was impractical because of the extraneous a.c. pickup in the high impedance microphone line. This voltage, plus that developed by ambient noise in the room, was not sufficient to trip the relay, but was enough to prevent fallout once the relay was actuated. Use of a low impedance microphone and shielded input transformer was precluded in this special case because of cost.

Measurement demonstrated that the instrument had to discriminate between a noise and noise-plus-signal voltage, differing by about one volt peak. Obviously a relay directly operated could not be relied upon to do this consistently. However, the *Schmitt* switch often used to trigger a synchroscope sweep is capable of resolving these small differences. It can be arranged to operate on positive or negative pulses differing by less than 0.5 volt. The basic circuit is shown in Fig. 1A.

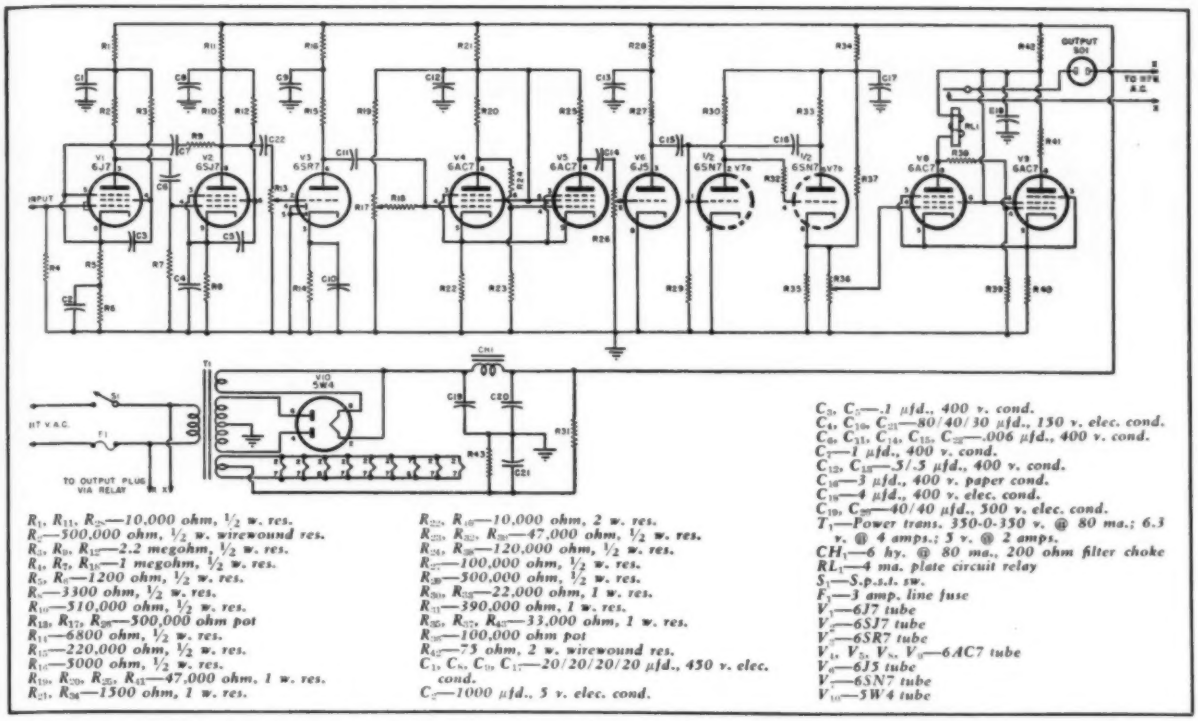
Fig. 1. (A) Simplified circuit of Schmitt switch. (B) Simplified circuit of relay switch. (C) Block diagram of the alarm.



For use as a device actuated by a negative pulse, the voltage on the grid of V_1 is set by R_2 at a value greater than that on the grid of V_2. Plate current flowing in R_4 then keeps the grid of V_2 biased to cut-off so that the voltage at the plate of V_2 is nearly that of the high voltage supply. A negative pulse applied to the grid of V_1 gives it a negative reference to the voltage applied to the grid of V_2 and increases the current through R_4, allowing V_2 suddenly to conduct, thereby producing a negative pulse at its plate. The reverse process occurs when the grid voltage of V_1 rises again. This switch has two stable limiting conditions dependent on the voltage on V_1 and may be used to actuate a relay if the input pulse is of sufficient duration. The amount of voltage required to change the condition of operation depends on the difference in voltages applied to the grids of the two tubes.

Using the *Schmitt* circuit solved the noise-*vs*-signal problem, but its output would not actuate a relay when operated directly from the signal amplifier. This is due to the fact that speech (and a baby's howling) is a series of relatively short bursts. Since the *Schmitt* switch works very rapidly, keying on and off with each burst, it would not remain conducting for the finite time required to close the relay. Also it was necessary to hold the light on a short while after keying.

To give a pulse of sufficient duration to close the relay and prevent instantaneous opening, the discriminator output pulse is used to key a "one shot" multivibrator with a relatively long time constant. The basic circuit arranged for negative pulse keying is shown in Fig. 1B. A positive-going relatively square pulse may be had from the cathode of V_2 provided the loading does not appreciably alter the operating condition of V_2. It was impossible to operate the relay directly from the multivibrator so another *Schmitt* switch, direct-coupled to the



R_1, R_{11}, R_{27}—10,000 ohm, ½ w. res.
R_2—500,000 ohm, ½ w. wirewound res.
R_3, R_9, R_{12}—2.2 megohm, ½ w. res.
R_4, R_7, R_{13}—1 megohm, ½ w. res.
R_5, R_8—1200 ohm, ½ w. res.
R_6—3300 ohm, ½ w. res.
R_{10}—510,000 ohm, ½ w. res.
R_{18}, R_{37}, R_{38}—500,000 ohm pot
R_{14}—6800 ohm, ½ w. res.
R_{15}—220,000 ohm, ½ w. res.
R_{16}—5000 ohm, ½ w. res.
R_{19}, R_{39}, R_{42}, R_{43}—47,000 ohm, 1 w. res.
R_{21}, R_{24}—1500 ohm, 1 w. res.
R_{22}, R_{40}—10,000 ohm, 2 w. res.
R_{23}, R_{32}, R_{36}—47,000 ohm, ½ w. res.
R_{25}, R_{34}—120,000 ohm, ½ w. res.
R_{26}—100,000 ohm, ½ w. res.
R_{27}—500,000 ohm, ½ w. res.
R_{30}, R_{33}—22,000 ohm, 1 w. res.
R_{31}—390,000 ohm, 1 w. res.
R_{35}, R_{37}, R_{41}—33,000 ohm, 1 w. res.
R_{38}—100,000 ohm pot
R_{42}—75 ohm, 2 w. wirewound res.
C_1, C_8, C_{11}, C_{17}—20/20/20/20 μfd., 450 v. elec. cond.
C_2—1000 μfd., 5 v. elec. cond.
C_3, C_7—.1 μfd., 400 v. cond.
C_4, C_{10}, C_{23}—80/40/30 μfd., 150 v. elec. cond.
C_6, C_{21}, C_{24}, C_{15}, C_{22}—.006 μfd., 400 v. cond.
C_9—1 μfd., 400 v. cond.
C_{12}, C_{18}—.5/.5 μfd., 400 v. cond.
C_{16}—3 μfd., 400 v. paper cond.
C_{19}—4 μfd., 400 v. elec. cond.
C_{20}, C_{26}—40/40 μfd., 500 v. elec. cond.
T_1—Power trans. 350-0-350 v. @ 80 ma.; 6.3 v. @ 4 amps.; 5 v. @ 2 amps.
CH_1—6 hy. @ 80 ma., 200 ohm filter choke
RL_1—4 ma. plate circuit relay
S_1—S.p.s.t. sw.
F_1—3 amp. line fuse
V_1—6J7 tube
V_2—6SJ7 tube
V_3—6SR7 tube
V_4, V_5, V_6, V_8—6AC7 tube
V_6—6J5 tube
V_7—6SN7 tube
V_{10}—5W4 tube

Fig. 2. Complete circuit diagram and parts list for a sound alarm unit which is designed to provide a visual warning signal.

cathode of the multivibrator, is used as a relay switch. In this case V_1 of the switch is biased to cut-off and a relay inserted in its plate circuit. Since the resting current here may be as near zero as desired, there is no problem of relay fallout not occurring when the unstable regime of the multivibrator has been completed.

Fig. 1C shows the block diagram of the unit. It can be seen that the timing of the whole sequence of events depends on the duration of the unstable portion of the multivibrator's cycle and that it will automatically reset and be ready for another stimulus at the end of this period. The input to the multivibrator and its output to the relay-actuating switch circuit must be adjusted to give a positive switching action, yet not be so great as to cause these circuits to draw grid current and block them for undesirably long periods.

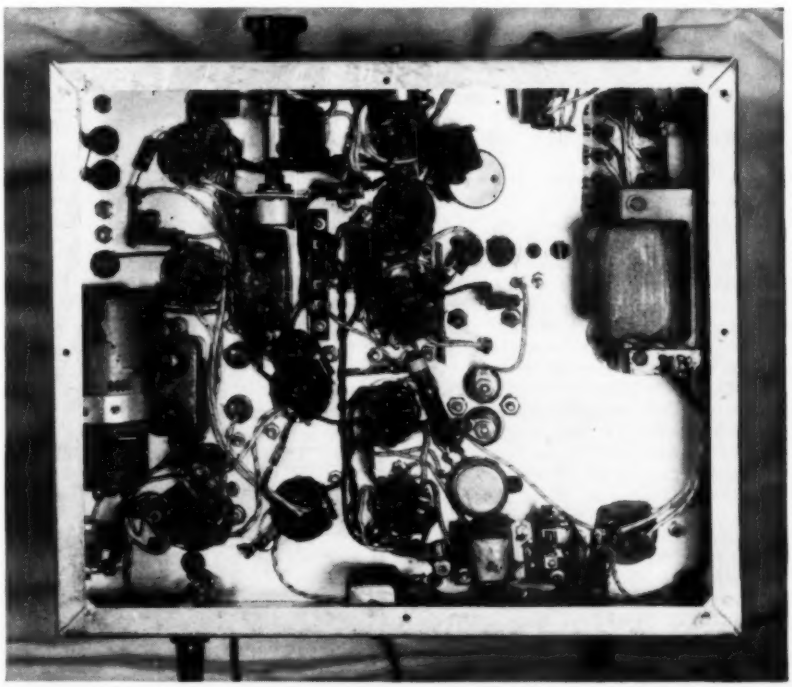
Fig. 2 shows the circuit of the complete instrument. V_1, V_2, and V_3 comprise a simple, high gain amplifier. Extended range of response is actually undesirable in this application, since low rumbles (street noises) and very high-pitched sounds should not actuate the relay. The inverse feedback over V_1 and V_2, therefore, is not for the purpose of range extension, but to reduce internal noise and stabilize gain. R_{13} is a standard gain control and is used to adjust the sensitivity of the instrument.

The output of this amplifier triggers the first switch circuit, V_4 and V_5, whose output is tapped off R_{25} and used to trigger the multivibrator V_7. R_{17} controls the voltage at which the switch triggers, thus the degree of discrimination between noise and signal. R_{26} and the pulse amplifier, V_6, control the height of the trigger signal to V_{7a}.

The potentiometer, R_{38}, couples the multivibrator to the second switch circuit, V_8 and V_9, and also controls the steady-state bias on the grid of V_{8a}, thus determining when the switch will change from one regime to another and close the relay.

The circuit may seem complex for so simple a job, but does fulfill the requirements of stability and reliability which the many simpler circuits which were tried could not do. —50—

Under chassis view. Standard and readily-available parts are used throughout.



THE TV PICTURE TUBE

Metal picture tubes, like the RCA 17-inch unit shown above, combine a large face with light weight for ease of handling.

By
WALTER BUCHSBAUM
Television Consultant, RADIO & TELEVISION NEWS

Points to remember when replacing your picture tubes. Article covers basic tube types, their characteristics, and data on substitution.

THE picture tube is the heart of the television receiver, not only because it is the most bulky and expensive item, but because it produces the desired end result—the picture. Since the early days of TV the improvement in picture tubes has been the greatest concern of the industry, since bigger and better pictures depend on the tube. Thus we have seen the 5-or 7-inch round tubes of 1946 evolve as today's 20-and 30-inch round and rectangular picture tubes. Just how extensive this development has been is evidenced by the long list of picture tubes given on the "Data-Print" in this month's issue. Although there is considerable variation between tubes, certain basic features permit us to group them and classify them. The purpose of this article is to acquaint the technician with the great variety of available picture tubes and the use of each type in replacement and conversion work.

Three main classifications can be made immediately: electrostatic deflection, projection types, and magnetic deflection direct view tubes. We shall discuss them in this order.

Electrostatic deflection tubes: These tubes use deflection plates mounted inside the tube to sweep the beam vertically and horizontally. Focusing is also done electrostatically. The largest electrostatic deflection tube used in commercial sets is the 10HP4 although we list a 20AP4 which uses electrostatic deflection. This latter tube is found only in a few experimental receivers. The most common type is the 7-inch all-glass and the 8-inch metal-shell tubes used widely in portable TV sets. All of these tubes use less than 8 kv. second anode voltage and none require an ion trap. Before replacing an electrostatic picture tube with a different number, be sure that socket connections and voltages are correct. Some use a 12-pin and others a 14-pin socket.

Projection picture tubes: The 3NP4 is used in the so-called "folded Schmidt System" of projection TV manufactured by *North American Philips Co.* Careful handling because of the fragility and the critical adjustment of the optical system is the major factor when replacing this tube. The tube requires a special socket and is magnetically focused and deflected. Both focus coil and deflection yoke are specially made for this tube alone. The other projection tube is the 5TP4, used in practically all other projection-type receivers. The focus is electrostatic and requires a high voltage at the tube socket which often causes arcing and breakdowns. A special deflection yoke is also required for the 5TP4.

Magnetic deflection, direct view types: The vast majority of TV receivers use this type of picture tube. Ranging from 7-inch round to 30-inch round, these tubes all have several features in common. All sockets are of the 12-pin type and almost all socket connections are identical and interchangeable. Some of the latest electrostatic focus tubes utilize Pin 6 which is unused on other types. On all tubes Pins 1 and 12 are the filaments, 2 is the grid, 11 the cathode, and 10 is the first anode. Thus it is possible to interchange tube sockets without much difficulty. The second common feature is that they all need a deflection yoke.

Different deflection yokes, however, are required for different deflection angles and this is a particularly important consideration when converting to a larger picture tube. Larger screens require wider deflection angles and this, in turn, calls for a different deflection yoke and more sweep power, especially in the horizontal section. More powerful focus coils are also used on many of the larger tubes. This is indicated on the "Data-Print" by an asterisk which means that an RTMA #109 type (470 ohms) must be used instead of the standard RTMA # 106 (264 ohms). It is also important to have the correct anode voltages, focus

(*Continued on page* 139)

COMING IN NEXT MONTH'S ISSUE—"DATA-PRINT" NO. 5
"Television Conversion Guide"

This "Guide," when used with this month's "Data-Print," will provide pertinent information and circuit data for the rapid conversion of small-screen television receivers to large-screen operation.

An Improved SPEECH CLIPPER

Fig. 1. Front panel view of clipper. The unit indicates clipping level directly in decibels by means of flashing neon lamps.

By
L. C. WATKINS, JR.
W5JXO

Although designed for the ham, this unit may also be used by soundmen in connection with p.a. systems.

PREMODULATION speech clipping and filtering has become an accepted and proven method of obtaining increased sideband power from phone transmitters. The theory and benefits have been discussed so frequently that space will not be devoted to a detailed summarization here. A review of the more pertinent articles will be helpful to those persons interested. [1, 2, 3, 4, 5]

The disappointing results often obtained when clipping is attempted may usually be traced to one or more of the following situations: (1) Overmodulation due to phase shift in the filter that is necessary to use after the clipper, and phase shift in the audio circuits following the clipper-filter. (2) Skimpy or improper modulator design. (3) The use of an excessive amount of speech clipping, usually due to the lack of an accurate method of determining how many decibels of clipping are in use at any given instant. (4) Failure to eliminate noise and hum voltages from the low-level speech stages ahead of the clipper. (5) The use of clipping, in excess of a very few decibels, when the transmission path is subject to selective fading conditions.

Most of these problems have obvious solutions. Perhaps not so obvious is the fact that phase shift accounts for a major part of the unsatisfactory results which are sometimes noted.

The voice, as far as the instantaneous conditions are concerned, can be considered as various sine-wave combinations and even-order harmonics. A sine wave clipped 10.5 db has a shape factor of 0.9, which is nearly as great as the 1.0 shape factor of a square wave. A square wave is found to have only odd harmonics, being composed of an infinite number of sine-wave components of different frequencies and amplitudes.

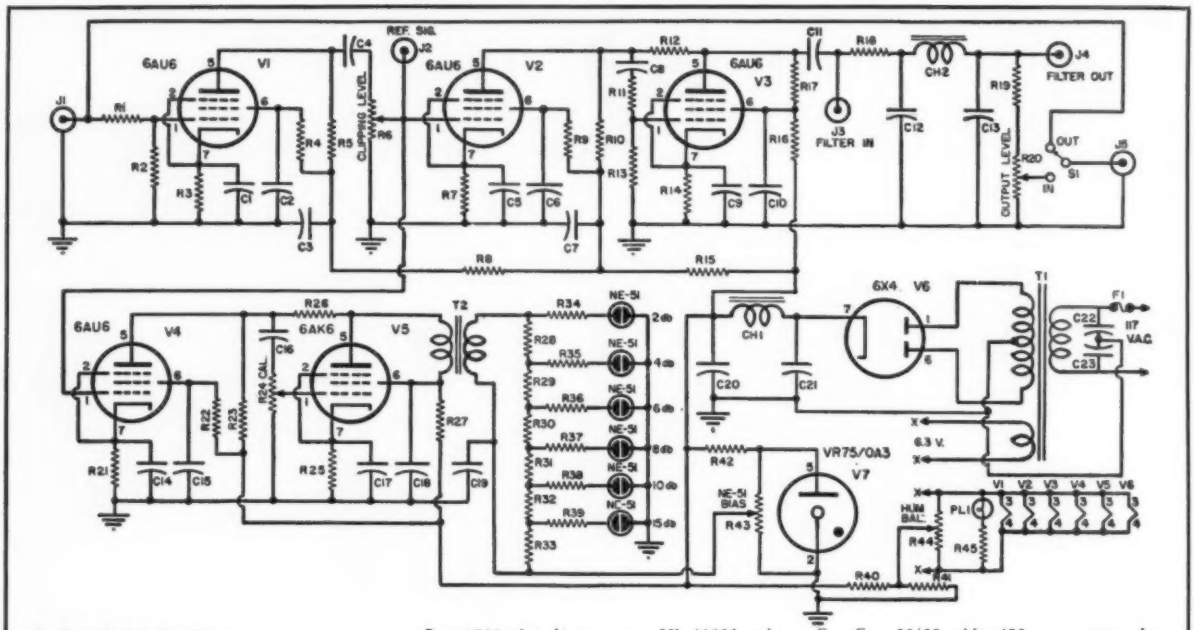
In order to preserve a square-wave signal through an audio system, the system must have (1) flat amplitude response and, (2) uniform time delay, so that the frequency components will retain the same alignment relative to one another that they had originally.

Any filter arrangement that provides a sharp cut-off, of which the common *m*-derived filter is an example, does not exhibit a linear phase-shift characteristic. The phase shift increases rapidly as the filter cut-off frequency is approached. This gives rise to a realignment of the frequency components present in the clipped wave, such that the new peak amplitude at the filter output is greater than that of the fundamental. In other words, full advantage cannot be taken of the original reduction in the waveform peak factor that clipping accomplished, since it is mandatory that the transmitter not be overmodulated.

Some relief may be afforded by using a constant-*k* filter section after the clipper instead of the *m*-derived type. The constant-*k* filter exhibits a much improved phase-shift characteristic for the purpose at hand, although it does not cut off as sharply as the *m*-derived filter. More important, it gives better attenuation at frequencies farther out from cut-off. In addition, the rather gradual attenuation characteristic seems to afford a greater element of voice "naturalness."[6]

One other situation inherent in the filter system is the loss in the average power of the clipped wave as it goes through the filter. Let us assume a filter cut-off frequency of 3000 cps and examine the clipped waveform at the filter output terminals. Assuming 200 cps as the fundamental frequency, then the fundamental and the 3rd through the 15th harmonics lie within the filter passband. The output waveform will be very square and will contain high average power. At a fundamental frequency of 400 cps, only the 3rd, 5th, and 7th harmonics lie within the passband. The output waveform is still quite square. With a 600 cps fundamental, the 3rd and 5th harmonics are passed, and the square waveshape has deteriorated considerably. Finally, with a 1000 cps fundamental, only the 3rd harmonic is passed, and the average power has suffered a large reduction. At frequencies higher than 1000 cps, only the fundamental components are passed and show up as sine waves, with their usual contribution to the average power of the total waveform.

The end result is to cause the voice frequencies lower than about 600 cps. to modulate the transmitter with a greater average power than the higher frequencies. This often results in the excessive "boominess" of some signals from a clipper-filter rig, especially if the voice characteristics of the operator tend to be on the "bass-y" side. In any case, frequencies below about 200 cps should be attenuated in the speech amplifier stages ahead of the clipper, and the operator with an unusually bass voice should carry the attenuation as high in frequency as is necessary to avoid excessive "boomi-



R_1, R_6—47,000 ohm, ½ w. res.
R_2, R_{11}, R_{12}, R_{19}—1 megohm, ½ w. res.
R_3—510 ohm, ½ w. res.
R_4, R_{13}, R_{16}—200,000 ohm, ½ w. res.
R_5—100,000 ohm, 1 w. res., low-noise, metallic-film type (Continental Carbon Type X-1)
R_7—100,000 ohm pot.
R_7—1100 ohm, ½ w. res.
R_9—560,000 ohm, ½ w. res.
R_{10}, R_{20}—220,000 ohm, ½ w. res.
R_{14}—470 ohm, 1 w. res.
R_{15}—22,000 ohm, 1 w. res.
R_{16}—22,000 ohm, 2 w. res.
R_{17}—15,000 ohm, 2 w. res.
R_{21}—1000 ohm pot.
R_{22}—1000 ohm, ½ w. res.
R_{23}—430,000 ohm, ½ w. res.
R_{24}—250,000 ohm pot. (screwdriver adjustment)
R_{25}—510 ohm, 1 w. res.
R_{26}—470,000 ohm, ½ w. res.
R_{27}—3000 ohm, 10 w. wirewound res.
R_{28}—1870 ohm, ½ w. res. ± 5% (2000 and 30,000 ohms in parallel)
R_{29}—1630 ohm, ½ w. res. ± 5% (1800 and 18,000 ohms in parallel)
R_{30}—1300 ohm, ½ w. res. ± 5%
R_{31}—1150 ohm, ½ w. res. ± 5% (1200 and 27,000 ohms in parallel)
R_{32}—1730 ohm, ½ w. res. ± 5% (1800 and 43,000 ohms in parallel)
R_{33}—2320 ohm, ½ w. res. ± 5% (2400 and 68,000 ohms in parallel)
R_{34}, R_{35}, R_{36}, R_{37}, R_{38}, R_{39}—30,000 ohm res. in NE-51 neon panel assembly (Dialco Series 95408, clear plastic cap)
R_{40}—120,000 ohm, 2 w. res.
R_{41}—18,000 ohm, 2 w. res.
R_{42}—10,000 ohm, 20 w. wirewound res.
R_{43}—10,000 ohm wirewound pot. (screwdriver adjustment)
R_{44}—100 ohm wirewound pot. (screwdriver adjustment)
R_{45}—22 ohm, 2 w. res.
C_1, C_3, C_{14}—20/20/20 μfd., 25 v. can-type elec. cond.
C_2, C_6, C_{15}—.25 μfd., 400 v. metallized-paper cond. (Aerovox Type P82 "Aerolite")
C_3, C_7, C_{10}—10/10/10 μfd., 450 v. can-type elec. cond.
C_4—.002 μfd., 500 v. mica cond.
C_5—.005 μfd., 500 v. mica cond.
C_9, C_{17}—50 μfd., 25 v. tubular elec. cond.
C_{11}—.5 μfd., 400 v. metallized-paper cond. (Aerovox Type P82 "Aerolite")
C_{12}, C_{13}—265 μμfd., 500 v. mica cond.
C_{16}—.01 μfd., 600 v. metallized-paper cond. (Aerovox Type P82 "Aerolite")
C_{18}, C_{21}—20/20 μfd., 450 v. can-type elec. cond.
C_{19}—30 μfd., 150 v. can-type elec. cond.
C_{20}—10 μfd., 450 v. can-type elec. cond.
C_{22}, C_{23}—.05 μfd., 600 v. metallized-paper cond. (Aerovox Type P82 "Aerolite")
T_1—Power trans. 250-0-250 v. @ 60 ma.; 6.3 v. @ 2 amps.; 5 v. @ 2 amps. (unused) (Chicago Transformer #PV-60)
T_2—10 w. mod. trans., pri. imp. 10,000 ohms, sec. imp. 10,000 ohms (Merit Type A-3008)
CH_1—13 hy., 65 ma. filter choke, 500 ohms d.c. res. (Chicago Transformer #R-1365)
CH_2—22 hy. reactor, hum-bucking type (Thordarson Type T20C74)
J_1, J_5—Microphone connector
J_2, J_3, J_4—Insulated type banana test jack
S_1—S.p.d.t. toggle sw.
F_1—1 amp. fuse and holder
PL_1—6.3 v., .15 amp. pilot light, used in neon panel assembly with 30,000 ohm res. replaced by piece of solid wire (Dialco Series 95408, green plastic cap)
6—Type NE-51 neon lamps
V_1, V_2, V_3, V_4—6AU6 tube
V_5—6AK6 tube
V_6—6X4 tube
V_7—VR 75/0A3 tube

Fig. 2. Complete schematic diagram and parts list for the clipper. The unit is entirely self-powered.

ness." The lower audio frequencies add very little to the signal intelligibility and may be easily attenuated by the use of smaller-than-normal coupling condensers in the amplifier stages preceding the clipper.

The clipper described in this article was designed as a complete unit so that it could be connected to the input jack of nearly any existing speech amplifier. It incorporates a clipping indicator circuit to enable the operator to know accurately at all times the peak clipping level directly in decibels.

The unit is quite compact, constructed of readily available components, and requires no elaborate calibration procedure. A special effort was made to reduce noise and hum voltages at the output terminals to a very low value. The circuit constants have been chosen to permit a passband of approximately 200 cps to 3000 cps.

Clipper-Filter Circuit

Reference to the schematic diagram, Fig. 2, will show the clipper amplifier to be an adaptation of a standard and well-proven handbook circuit. V_1 and V_2 are merely linear voltage amplifiers, and V_3 is the overdriven amplifier wherein the clipping actually occurs. A clipper system should be quite linear up to the point where clipping takes place in order to introduce the least amount of distortion into the signal. The degenerative feedback network from the plate of V_2 back to the preceding stage makes the amplifier-clipper considerably more linear than any of the series- or shunt-clipper diode systems on which the author has made measurements.

Resistor R_5 is a low-noise, metallic-film type and results in a substantial reduction in noise voltage output at the signal amplification values necessary to obtain 10-15 db of clipping. The lower right corner of the photograph of Fig. 5 will reveal that the author used two 50,000 ohm resistors in series to make up R_5, since they were already on hand in the desired type.

Potentiometer R_6 controls the clipping level and is one of the front panel controls.

The filter, made up of CH_2, C_{12}, and C_{13}, is of the constant-k type with a cut-off frequency such that the output signal voltage is down 3 db at 3000 cps, with reference to the output voltage at 1000 cps. A major stumbling block has been removed by designing the filter so that a readily available choke of accurately known characteristics could be used. It is the 22 hy. reactor of hum-bucking construction made by *Thordarson* for use in dual tone-control circuits. If the specified components are used, the reader will be able to duplicate the filter successfully without recourse to elaborate test equipment.

The filter is terminated in its design impedance of 200,000 ohms by R_{19}. The output-level potentiometer, R_{20}, forms a voltage divider with R_{19} to limit the maximum output voltage available at J_5 to about 80 millivolts, more than sufficient to drive the usual speech amplifier. About 20 volts of signal out-

put is available at the top end of the resistor R_{19}.

Banana jacks J_2 and J_3 are for calibration purposes, to be explained later. J_4 may be omitted, as it was included in the unit pictured to permit the convenient oscilloscopic examination of the filter output waveform during a group demonstration of the unit.

Clipping Indicator Circuit

The indicating circuit is a simple linear amplifier consisting of a voltage amplifier stage, V_4, and a power amplifier stage, V_5. The power amplifier and its output transformer, T_2, must be capable of handling a watt or so of power to provide a distortion-free signal with which to operate the six NE-51 neon indicating lamps. The lamps, when lighted, consume a small amount of power and also tend to vary the load impedance somewhat, as presented to the secondary of T_2. Inverse feedback around V_5 helps to stabilize the power stage against load variations and also lowers the distortion content of its output signal. T_2 is a small and inexpensive modulation transformer, set up for a one-to-one turns ratio.

Resistors R_{24} through R_{29} are current-limiting resistors for the neon lamps and are already provided in the neon panel assembly sockets. The values of resistors R_{25} through R_{33} are such as to cause the neon lamps to flash with the desired decibel relationship in accordance with the amplitude of the voltage across the secondary of T_2. The 4 db lamp is connected across 81.3 per-cent of the total voltage divider resistance; the 6 db lamp at 65 per-cent; the 8 db lamp at 52 per-cent; the 10 db lamp at 40.5 per-cent; and the 15 db lamp at 23.2 per-cent of the total resistance.

The NE-51 bias control, R_{32}, varies the regulated positive bias voltage applied to the six neon lamps. The bias is adjusted so that the lamps normally are just on the verge of firing, resulting in a much smaller amplitude of audio signal voltage needed to trigger them. Condenser C_{19} provides a low impedance path to ground for the audio voltage, without short-circuiting the bias voltage. The condenser should be large, at least 50 μfds.

An audio signal applied to the grid of V_1 is amplified linearly, and so on through V_2 and V_3 unless the signal is increased enough so that V_3 begins to clip. After clipping commences, the signal at the grid of V_3 will continue to rise linearly, as the clipping level control is advanced. If a certain reference signal voltage at the grid of V_3 will just cause clipping to commence, then any desired number of decibels of clipping may be determined by allowing the V_3 grid signal to increase by the proper multiplying factor. A ratio of 1.3:1 will provide about 2 db of clipping, and a ratio of 5.6:1 will provide 15 db of clipping.

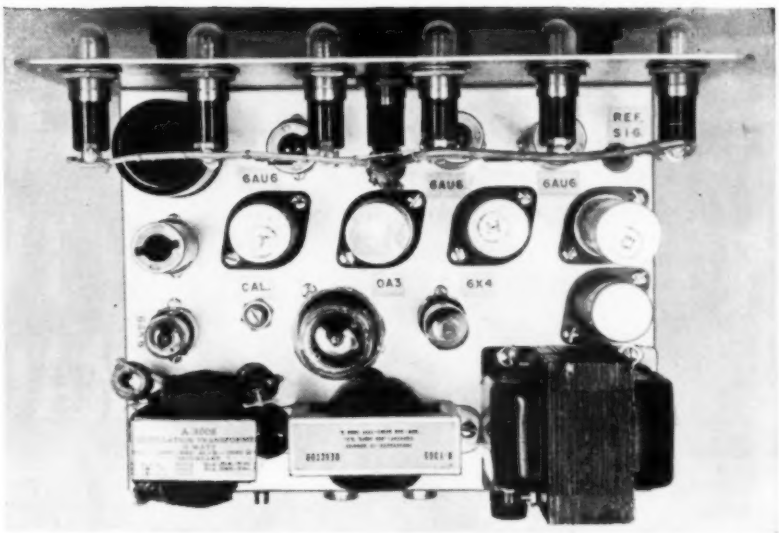


Fig. 3. Top chassis view of the speech clipper showing recommended parts layout.

These figures indicate that a large increase in the amplifier gain is necessary ahead of the clipper to produce substantial amounts of clipping. Even an inch or two of variation in the speaking distance from the microphone, or a slight variation in the voice level, will change the clipping level by several decibels. A truthful indicating circuit should possess no operational inertia and should be activated by the instantaneous voice peaks, instead of the average voice level.

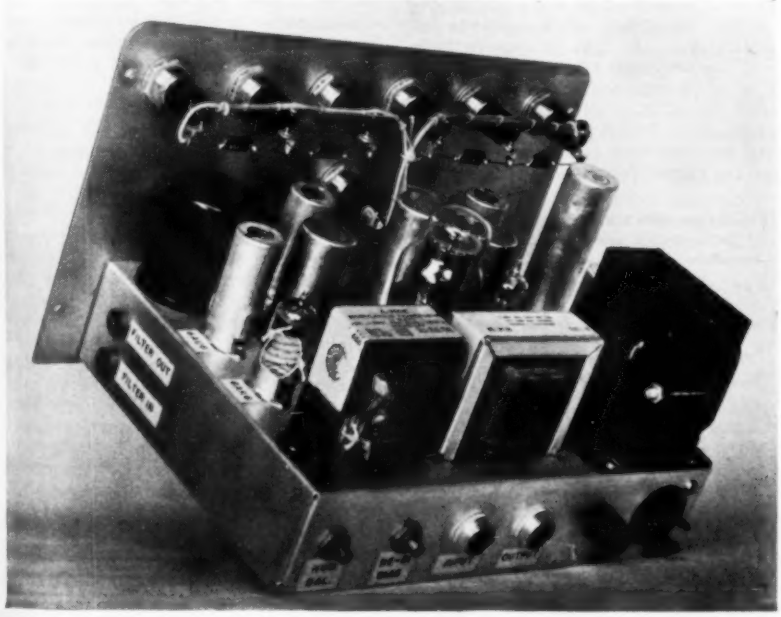
The indicating amplifier is linear in operation, so all that is necessary is to adjust R_6 for a 2 db clipping level, then adjust R_{24} until the 2 db lamp just lights. Further increases in the setting of R_6 will produce corresponding increases in the output of V_5, and the remaining lamps will light, one after another, in the proper decibel relationship.

This unit was designed for a maximum normal clipping level of 10 db, as it is doubtful whether clipping much in excess of this figure is practical. Acoustic background in the operating location may even then prove annoying. Another important factor that should be emphasized is that the voice quality is still very acceptable at the 10 db figure.

Hum voltage in the output is reduced practically to the vanishing point by using a hum-balancing potentiometer across the power transformer 6.3 volt heater winding, and by placing about 35 volts of positive bias on the tube heaters. The brilliance of the 6.3 volt pilot lamp is reduced by a series voltage-dropping resistor, R_{35}, to provide

(*Continued on page* 129)

Fig. 4. Top-rear view of chassis. The neon lamp voltage divider resistors are soldered directly to the lamp socket terminals as shown in the photograph.



A UNIQUE TV SIGNAL TRACING PROBE

By
E. G. LOUIS

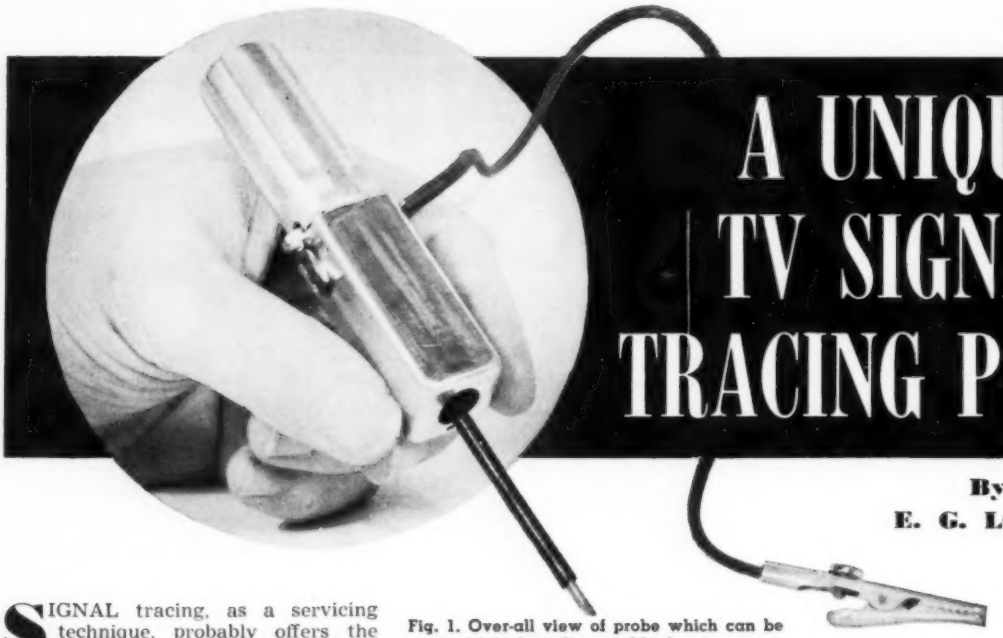


Fig. 1. Over-all view of probe which can be used with both medium and high-gain scopes.

Unit permits detection of r.f. and i.f. signals and has a stage of direct-coupled wide-band amplification.

SIGNAL tracing, as a servicing technique, probably offers the most rapid and accurate method for definitely isolating distortion, hum, or weak operation to a specific stage. Unfortunately, this valuable technique has, in the past, been somewhat difficult to apply to TV receivers due to the comparatively low signal levels present in the video i.f. stages. The difficulties stem primarily from the fact that many service type cathode-ray oscilloscopes do not have sufficient gain in the vertical amplifier to permit direct observation of a detected TV signal unless the signal level is quite high.

To overcome these difficulties, the probe shown in Fig. 1 and diagrammed in Fig. 2 was designed. This probe not only permits detection of an r.f. or i.f. signal, but also provides a stage of *direct-coupled wide-band amplification.* Although designed originally for TV servicing, the probe may be readily adapted for use in signal tracing AM and FM receivers.

In actual servicing tests, the probe shown in Fig. 1 was used with both medium and high-gain oscilloscopes. It was found that the video signal could be detected and observed *up to the output of the TV front-end* when local TV stations were being received. Thus, it is possible to make gain and quality tests of individual stages in the entire i.f. strip. Since the scope, alone, may be used to observe signals following the video second detector and in the sweep and sync circuits, the addition of this probe to the tools of the service shop or laboratory permits the technician to observe and study signals present in any section of the TV receiver. The advantages in servicing are obvious.

Circuit Description

Referring to Fig. 2, a twin-triode tube is used. One-half of the tube is connected as a diode detector with R_1 and R_2 acting as the diode load resistors. The probe condenser C_1 is kept low in value to minimize loading and detuning when the probe is used to check signals in tuned i.f. stages.

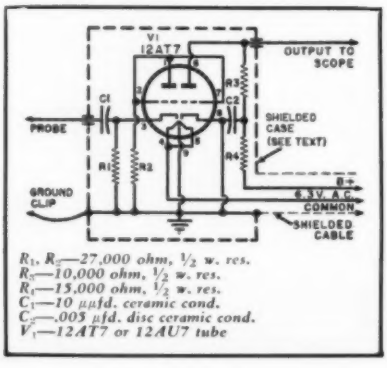
A demodulated signal appears across R_2 having both a.c. and d.c. components. The d.c. component serves as a bias voltage for the direct-coupled amplifier following the detector. Note that the grid of the triode amplifier is connected directly to R_2.

An amplified video signal appears across the amplifier load resistor R_3, and this is applied to the input of the vertical amplifier of a cathode-ray oscilloscope. R_3 has purposely been kept low in value to minimize the effects of distributed capacity and the input capacity of the CRO, thus assuring good bandwidth and an accurate reproduction of the video signal. For the signal tracing technique to be really useful in tracking down the source of distortion, it is important that the probe itself introduce no distortion of the video signal.

R_4 and C_2 together act as a decoupling filter, preventing or minimizing any effects due to power supply coupling. This permits the power supply of either the TV receiver or the CRO to be used for operating the probe. (A separate power supply may be used if available, of course.)

If the builder plans to use the probe primarily for servicing AM or FM receivers where extreme bandwidth of the amplifier is not important, R_3 may be made several times larger, with a resulting increase in stage gain.

Fig. 2. Complete schematic diagram of the TV probe which uses a twin-triode tube.



R_1, R_2—27,000 ohm, ½ w. res.
R_3—10,000 ohm, ½ w. res.
R_4—15,000 ohm, ½ w. res.
C_1—10 μμfd. ceramic cond.
C_2—.005 μfd. disc ceramic cond.
V_1—12AT7 or 12AU7 tube

Construction Hints

If a metal, plastic, or fiber tube is available, the probe may be assembled in it, using conventional construction techniques. An old electrolytic "can" may also be used.

However, it has been the author's experience that when a tube is needed, one can seldom be found even at the local radio wholesalers. And electrolytic condensers seem to suddenly acquire a new lease on life if a defective one is needed. Therefore, an effort was made to design the probe so that construction could be undertaken with parts which are almost always available in the service shop or in an experimenter's "junk box." The probe shown in Fig. 1 was the result.

Fig. 4 is an "exploded" view of the probe, showing the essential features of construction. The only machine work necessary is a single drilled hole in the side of the i.f. can for the power

cable and signal lead. The hole in the end of the i.f. can is already present—this is where the coil or trimmer condenser was mounted.

The probe "point" is a 2½" length of #12 tinned bus bar, with the end pointed and a piece of spaghetti tubing slipped over its length (see Fig. 1).

The end of the power supply cable may be terminated in several ways, depending on the power supply to be employed. If an experimental supply is to be used, terminate the cable in spade lugs, so that easy connections may be made to a screw-type terminal strip. The power supply of the TV receiver being serviced may be used to supply the probe; in this case, terminate the power leads in alligator clips for ease in making connections in the receiver.

Since the power required by the probe is small, the scope itself can easily furnish the necessary filament and "B" voltages. In this case, terminate the power cable in a power plug and mount an appropriate socket on the scope.

The signal lead should be terminated in a spade lug for ease of connection to the scope vertical input binding post. This lead may be shielded if necessary to keep hum and noise pickup to a minimum, but a low-capacity coaxial cable should be used to minimize high-frequency loss. If the scope power supply is used for the probe, a separate ground connection to the scope is not necessary. Otherwise, provide ground bonding between the scope and the TV receiver.

The "B plus" may be any value from 150 volts to 250 volts. If greater voltages are available, use a resistance voltage divider to obtain the necessary operating voltage.

Applications

Once the construction and wiring is completed and checked, the builder should connect the probe to a power source and CRO, not only to check its operation, but also to gain familiarity with its use and limitations.

In Fig. 3 are shown, in block diagram form, the video i.f. stages of a typical TV receiver. Other portions of the receiver, including the power supply, have been omitted for purposes of clarity. The points at which the probe may be used for checking the video signal are indicated as *A*, *B*, *C*, *D*, and *E*. After the video 2nd detector, the scope may be used without the probe for checking signal quality.

To use the probe, connect the flexible ground lead to a convenient chassis point and touch the probe end to the grid or plate terminal of the stage to be checked. Check the input to the stage by touching the grid, the output by touching the plate.

A local TV station should be tuned in and controls on the TV receiver adjusted for normal operation.

The scope controls should be adjusted for a linear sweep, using internal sync. A sweep frequency of from 20 to 30 cps may be used to observe the field signal, while a sweep from 5000 to 8000 cps may be used to observe the line signal. Adjust the *vertical gain* control until the observed video signal is of the desired amplitude. "*Sync*" and "*Fine Frequency*" controls should be adjusted for a stable pattern.

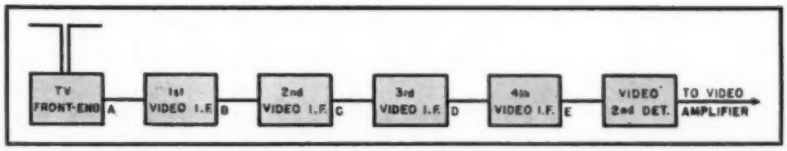


Fig. 3. Block diagram of the video i.f. stages of a conventional television receiver.

With the set operating normally, the observed video signal (using approximately 20 cps sweep in scope) will appear somewhat as shown in Fig. 5A. A hazy band representing the sync pulses should be clearly visible at the top of the video signal (1 in Fig. 5A), while the lower edge of the video signal will be uneven and ragged (2 in Fig. 5A). If a test pattern or fixed signal is being transmitted, the video pattern will be fixed between pulses. A program, on the other hand, will give a video signal in which the pattern between pulses is constantly shifting in form and shading.

To measure stage gain check the relative amplitude of the input and output signals of a single stage, dividing the output level by the input level.

As an example, suppose it was desired to check the gain of the 2nd video i.f. stage of a TV receiver (Fig. 3). First, touch the probe to point *B* and adjust the vertical gain control of the scope for a small deflection (two squares on the scope graph scale would be satisfactory). Now, *without touching the vertical gain control of the scope,* transfer the probe to the plate of the i.f. stage (point *C*). Check the amount of deflection obtained and divide by the deflection obtained in the previous test.

If 22 squares of deflection are obtained when checking the signal amplitude at point *C*, with 2 squares of deflection obtained at point *B*, the gain of the 2nd video i.f. stage is 11.

Hum in the video i.f. stages may be caused by stray coupling, an open grid circuit, heater-to-cathode leakage, or defective bypass or filter condensers. Sixty-cycle hum is usually caused by one of the first three defects listed,

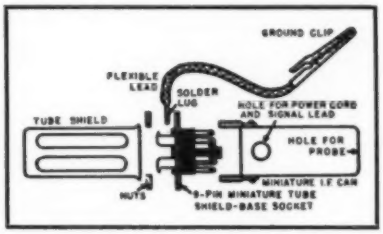


Fig. 4. "Exploded" view of probe showing the most important construction features.

while 120-cycle hum is generally caused by the last two defects.

When the probe is used to check the video signal directly in the i.f. stages, hum is readily apparent as a ripple superimposed on the video signal as shown in Fig. 5B. Where the field signal is observed, 60-cycle hum will produce one complete cycle for each "cycle" of video signal, while 120-cycle hum will cause twice as many ripples in the signal.

Checking each i.f. stage individually permits rapid isolation of the stage at which hum is introduced. Components in that stage may be checked using conventional techniques.

Open bypass or filter condensers may be easily identified by using the probe to check for the presence of a video signal at the bypassed point. As an example, a screen-grid bypass condenser may be checked by touching the probe point to the screen-grid terminal of the tube. The presence of a video signal at this point indicates an open or partially open bypass condenser.

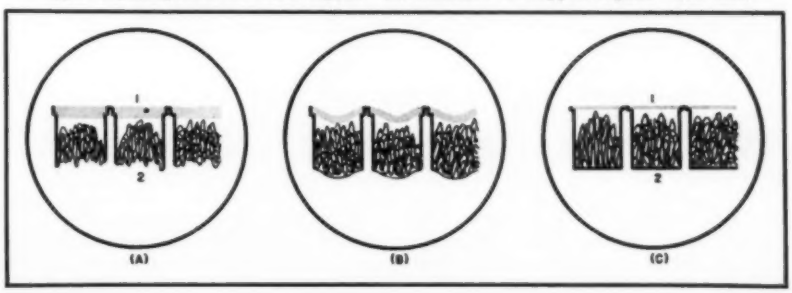
Open condensers in the i.f. stages may cause regeneration and oscillation, distortion, and other complaints.

Individual stage oscillation is readily identified by checking the video signal at each point in the TV receiver i.f. strip, starting at the front-end and working towards the video 2nd detector stage.

Distortion in the video i.f. stages may cause a number of complaints, ranging

(*Continued on page* 84)

Fig. 5. (A) "Normal" video signal as seen on scope. (B) 60-cycle hum appears as a ripple superimposed on video signal. (C) Flattened or clipped signal. See text.



Mac's RADIO SERVICE SHOP

By JOHN T. FRYE

DOG DAY DISCUSSIONS

THE August afternoon heat was hot and oppressive, but both men in Mac's Radio Service Shop were too busy to notice it. Barney was fussing away at a little a.c.-d.c. chassis on the service bench, and behind him his boss was checking out a TV set that had just been returned to its cabinet. Mac kept switching the receiver from one weak signal to another and listening intently to the sound as the snow came and went on the screen.

"Now that," he finally said as he stepped away from the set, "is my idea of a really successful fringe-area conversion job."

"Let's not break our arm patting ourselves on the back, shall we?" Barney suggested sarcastically as he looked up from the receiver that was very obviously giving him a hard time. "What's so good about that particular conversion?"

"The fact that it was really engineered in the laboratory of the manufacturer who built the set. This receiver was a good performer in the strong-signal area for which it was designed, but the intercarrier sound became very weak and buzzy when the set was used out here in this ultra-fringe location. When the manufacturer began getting complaints of noisy sound in fringe areas, he did not take the easy way out of explaining that the receiver was not intended for fringe-area use; instead he set his engineers to the task of seeing what could be done to help technicians clear up this condition in the field.

"The result is a kit that comes with all needed parts and is complete with detailed diagrams, drawings, and step-by-step instructions for performing some thirty operations on this particular chassis that will result in bringing up the sound without, in any way, impairing the picture."

"Thirty operations! Whew! That must take a lot of time and cost the customer a lot of dough."

"On the contrary, and that is why I like the conversion job. All of the time-consuming cutting-and-trying and de-bugging has been done by the engineers. The technician has only to follow the action-by-action instructions which are so clearly prepared that he can do this at a gallop. The complete rewiring job can be done in a couple of hours at the outside, and another half-hour is ample for the required realignment. The important thing, though, is how well it works. Notice that right now the picture is so snowy you can hardly make it out, yet the sound is clear and strong. Before, on a signal that weak, all you would be getting from the speaker would be a loud roar. When the customer gets this set back, he is going to have to quit calling it his 'Pantomime Special.'"

"What kind of changes did you make, anyway?"

"Put in two new traps; changed the loading resistors across the i.f. transformers; cut the first i.f. tube off the a.g.c. bus; put a new sound i.f. transformer in place of the former inductance-capacity coupling arrangement; and then realigned the video and sound i.f. channels and reset all traps."

"I gather you are not very enthusiastic about technicians working out their own methods of souping up sets for fringe-area reception."

"If by 'souping up' you mean making unauthorized circuit changes or radical changes in alignment, you are right. It is not that I question the technicians' knowledge, for many of them really do have a sound grasp of both theory and practice; but practically none of them have the kind of equipment needed to do design engineering work. Modern service equipment is good, but it makes no pretense of equaling laboratory equipment; yet without such precision instruments it is impossible to measure the exact effects of a particular circuit change. When a technician is working without the original performance data and when he has only service instruments for doing his measuring, it is very, very easy for him to cure one particular fault but to produce two other faults in the process. You and I have seen some cases of that come into the shop.

"So-o-o," Mac went on, "I think the technician will do well to follow the advice of the old adage: 'Let the cobbler stick to his last.' I know it is a great temptation to him to display his knowledge and ability by completely reworking a television receiver, and by doing so he can often build up a cheap local reputation for himself as an electronic wizard who knows 'more about a TV set than the men who built it'; but no matter what the layman believes, there is often a great and important difference between changing a set and improving it, especially when accurate equipment for checking the *complete* results of any change is lacking.

"Personally, I am content to follow the manufacturer's recommendations with regard to changing the original design. If I spot what I believe is a weakness or shortcoming in that design, I do not hesitate to call it to the set-maker's attention and ask for advice in correcting it. Invariably I receive a courteous answer that usually includes specific instructions for straightening out the trouble. I have confidence in those suggestions because I know they have been worked out by men who make design their business, who know the receiver as they know the backs of their hands, and who have thousands of dollars worth of precision equipment for checking every move they make."

"Yeah, but aren't you afraid that people will say the guy who cooks up his own changes is a better electronics man than you are?"

Mac's eyes twinkled in a grin as he answered, "That won't seem so important when you get a little older. I don't want to be known as a good 'electronics man.' I just want to be a first-class technician whose primary job it is to see that radio and television sets keep playing as well as they did the day they left the factory. Maybe the frustrated-engineer type of technician feels apologetic about being 'just a technician,' but I don't. I think the service problems I solve require just as much intelligence and knowledge of practical theory as do the design problems worked on by the engineer, but the schooling, technique, and equipment that each of us uses is different. It is like the difference between the

(*Continued on page* 126)

THE "DIALAUDIO" SYSTEM

Telephone dial is used as a simple remote control to permit the selective switching of audio inputs.

Pilot light assembly. See Chassis A in Fig. 1 for data on how this is set up.

By
BUDD MEYER
Audio Consultant

ONE of the great problems involved in the design and installation of custom high fidelity equipment is that of switching the various inputs. Most of the commercially available amplifiers and preamps have provision for five inputs, namely: FM and AM radio, tape recorder output, records, and TV. There are, of course, many variations, but the aforementioned sources of program material are the ones usually provided.

There have been many instances where the average consumer has become quite confused by the great number of controls and switches incorporated in some custom installations. The unit described herein, although designed for a particular installation, has the advantage of great flexibility. The same basic components can be used not only to switch various sources of program material into the amplifier but can be used to switch various speaker combinations and, in many cases, provide power to the various units comprising the complete installation.

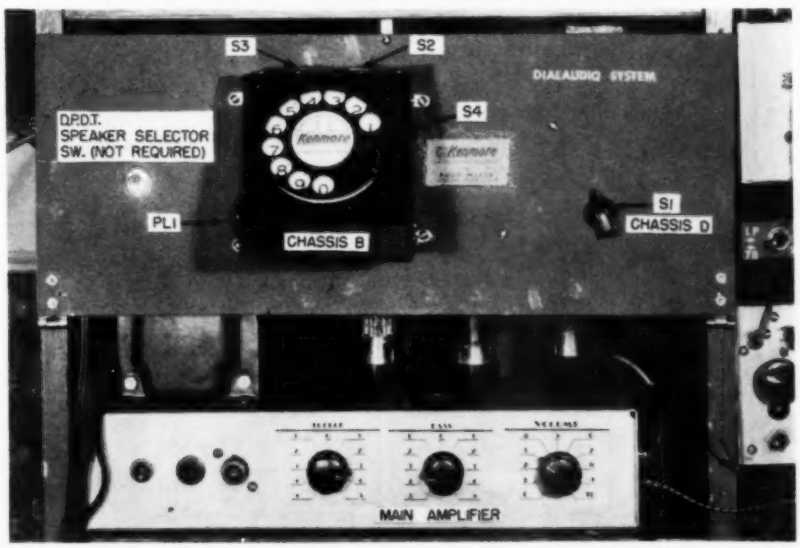
Although the author designed this particular equipment to handle the audio equipment which made up his "home entertainment center," this same "Dialaudio" system can be adapted to operate a wide variety of units. It can be used by dealers to tie-in various pieces of audio equipment for demonstration purposes, etc., and can even be employed in miniature train operation and other similar applications.

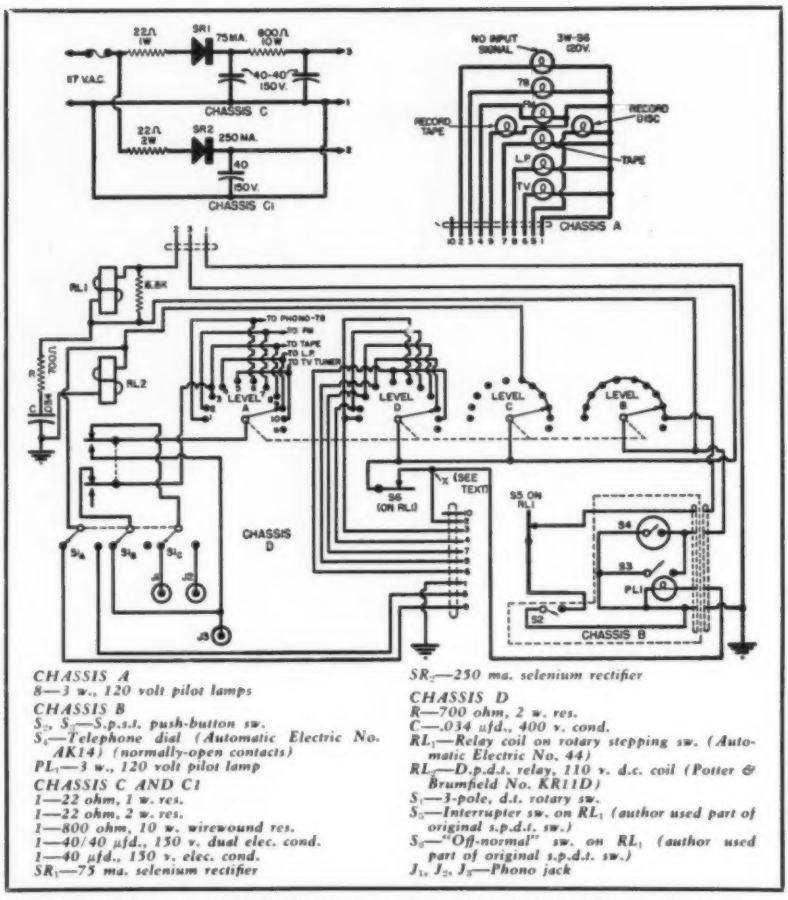
The "Dialaudio" system utilizes a telephone-type dial and a rotary step switch to accomplish rapid and positive switching with a minimum of components. In combination with a pilot lamp panel it is not a difficult task to route the desired program material to the amplifier or the output of the amplifier to any speaker or combination of speakers throughout a home. It is also possible to control this routing remotely by running wires to the dial chassis located at a convenient point. The dial chassis with associated push-button switches used in this system was designed so that it could be removed in its entirety from the mounting panel and used remotely.

As will be noted from Fig. 1, the system is designed around a type 44 rotary step switch manufactured by *Automatic Electric Co.* Technical specifications for the switch used in this particular design include: 4 level, 10 bank, 2 bridging and 2 non-bridging wipers, 110 volt d.c. coil for use with selenium rectifier power supply; Type 1C "off-normal" and 1C interrupter spring contacts. It seems as though telephone system engineers have a lexicon of their own because when translated into terms used by radio engineers it becomes a 4-pole, 10-position switch with 2 shorting and 2 non-shorting contacts. The 1C designation indicates single-pole, double-throw switches.

To explain the function of the "interrupter" and "off-normal" springs it is necessary to describe briefly the operation of the switch. The switch is indirectly driven, *i.e.*, it is stepped when the power is removed from the coil after a momentary application of power. Application of the power pulls a pawl from a toothed wheel which stores energy in a driving spring, and also releases a detent. Interruption of power allows the drive spring to drive

Over-all view showing main telephone dial panel and the audio amplifier.





CHASSIS A
8—3 w., 120 volt pilot lamps

CHASSIS B
S_2, S_3—S.p.s.t. push-button sw.
S_4—Telephone dial (Automatic Electric No. AK14) (normally-open contacts)
PL_1—3 w., 120 volt pilot lamp

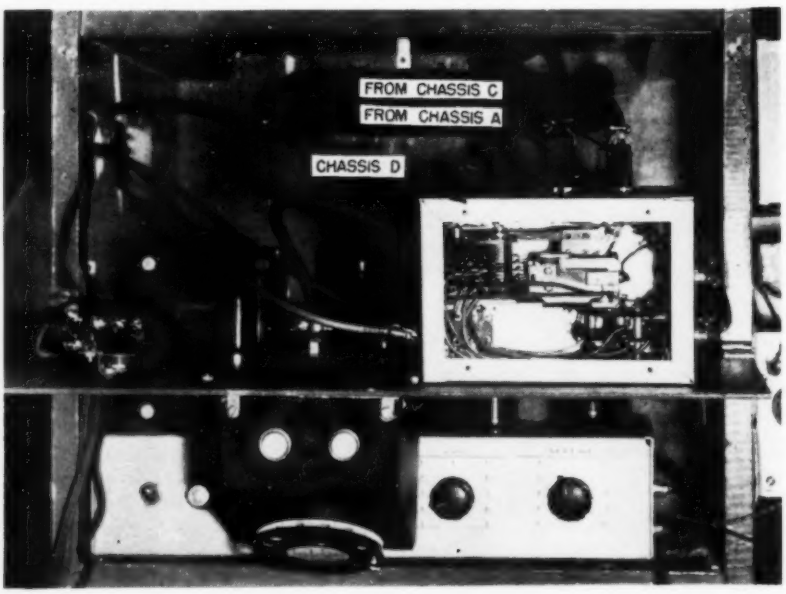
CHASSIS C AND C1
1—22 ohm, 1 w. res.
1—22 ohm, 2 w. res.
1—800 ohm, 10 w. wirewound res.
1—40/40 μfd., 150 v. dual elec. cond.
1—40 μfd., 150 v. elec. cond.
SR_1—75 ma. selenium rectifier
SR_2—250 ma. selenium rectifier

CHASSIS D
R—700 ohm, 2 w. res.
C—.034 μfd., 400 v. cond.
RL_1—Relay coil on rotary stepping sw. (Automatic Electric No. 44)
RL_2—D.p.d.t. relay, 110 v. d.c. coil (Potter & Brumfield No. KR11D)
S_1—3-pole, d.t. rotary sw.
S_5—Interrupter sw. on RL_1 (author used part of original s.p.d.t. sw.)
S_6—"Off-normal" sw. on RL_1 (author used part of original s.p.d.t. sw.)
J_1, J_2, J_3—Phono jack

Fig. 1. Schematic of "Dialaudio" system. Although author built Chassis C and C1 separately, it is possible to build both into a single unit. Jack J_1 goes to tape recorder for recording, J_2 goes to disc recorder, and J_3 goes to the main amplifier.

★ ★

Top view of the main telephone dial panel showing the position of Chassis D.



the pawl forward, engaging the toothed wheel and driving it forward one step until the detent stops its forward motion. This action positions the movable contacts (brushes) on one of the stationary contacts. The relay rotates in one direction only and all contacts are traversed in one-third of a revolution.

The brush assembly incorporates an indicator wheel which has cams spaced 120 degrees apart. When the brushes are not engaging any of the contacts (Pos. 11), the cam closes the contact on the "off-normal" springs. "Off-normal" means that the brushes *are* resting on any one of the contacts. The "off-normal" contacts are actuated every one-third revolution. The interrupter contacts are so arranged physically that when the relay coil is energized an armature actuates the switch lever which opens a contact on the interrupter assembly, thereby providing the power interruption needed to step the switch.

The five inputs for this particular system are: Position 1—Output from dynamic noise suppressor (for 78 rpm records); Position 2—Output from FM tuner; Position 3—Tape playback and monitor; Position 4—Output from preamp-equalizer for LP records; and Position 5—Output from TV audio strip for recording. These inputs are fed into Positions 1 through 5 on level *A* of the rotary switch. Positions 6 through 10 are paralleled with 1 through 5 when recording. Level *C* is used to power the relay for recording. Level *D* is used to provide pilot light indication. Level *B* is used to "home" the relay.

"Homing" is another word peculiar to telephone system engineers. By "homing" is meant the rapid return to normal position, *i.e.*, when brushes are not resting on any of the contacts and therefore no signal is being fed into the amplifier. It will be noted that Level *B* is wired so that when switch S_3 is closed, the rotary switch drive magnet circuit is completed to ground through all the contacts on that level and through the interrupter springs. This provides the power interruption needed to step the switch. This feature is extremely useful when using the dial as it provides a definite starting point for the dialing, eliminating the necessity for counting how many steps to advance the step switch in order to stop on the desired position. By skipping a contact on Level *B* it is possible to have the brushes come to rest on a predetermined contact by merely pressing the "homing" switch S_3.

Although the contacts will carry 3 amperes when at rest, it is not advisable to exceed 11.5 watts while they are in motion.

The system herein described was designed around a particular installation which was complicated by the fact that it was necessary to provide a means of automatically monitoring the tape while recording, a feature which made the use of an additional relay mandatory. Switch S_1 provides a means of

routing the signal to either the tape or disc recorder and giving an indication on the pilot panel. It also serves as routing switch for the monitor signal from the tape unit.

Fig. 1 also shows the power supplies used for the entire system. It had been originally planned to use one supply for the step-switch, the record relay, and the pilot lights. However, as the step-switch draws approximately 180 ma. during operation, the voltage drop across the filter circuit resistor was too high to insure positive record relay operation. In addition to the filtering action of the 800 ohm resistor, it also serves to drop the voltage for the record relay and pilot lights to 125 volts. In the "record" position with two lights and the record relay actuated, the total current is 56 ma. Both supplies can, of course, be mounted on the same chassis but provision should be made for adequate ventilation.

The chassis used to mount the dial also contains push-buttons S_2 and S_3 for single stepping and "homing." A meter case for a 2" meter just fills the bill as all the large holes are already punched. For other types of mounting, the dial dimensions are given in Fig. 2. It is not necessary to use the dial, as the relay may be single-stepped using just an s.p.s.t. push-button switch. The dial is a type AK14, also manufactured by *Automatic Electric*. The number dialed indicates the number of steps the relay brushes will move. For example, if the brushes are on contact 2 and it is desired that they rest on contact 7, it is necessary to dial 5.

The dial assembly proper has an additional s.p.d.t. switch. As supplied by the manufacturer this switch has two of the contacts tied together by a metal link. In order to eliminate "key clicks" when the dial is executing its return motion, this link was removed and a shielded wire run from the amplifier input to the center lug of the switch. Another wire is run from the *normally open* contact to ground. Now when any number is dialed a cam closes the contacts and the amplifier input is shorted. At the completion of the return motion these contacts open, thereby removing the ground and permitting the program material to be fed into the amplifier.

A pilot light has been incorporated on the dial chassis to show when the step-switch is in the "home" position. This feature is desirable when the dial chassis is used at a position remote from the pilot light panel. By making the connection at point "X" a semi-permanent one, this pilot light can be used to indicate any predetermined setting of the step switch.

On the levels which contain the bridging brushes (Levels *A* and *B*) will be found twelve contacts. Contact 11 is the one used to connect the level (pole) to the external circuit. Contact 12 (not shown in Fig. 1) on Level *A* is used to ground the amplifier input when the step-switch is in the "home" position. If this contact is not grounded the amplifier input will be open and

(*Continued on page* 100)

Over-all view of part of the author's home sound reproduction system. The "Dialaudio" selector system may be seen in the lower right hand corner.

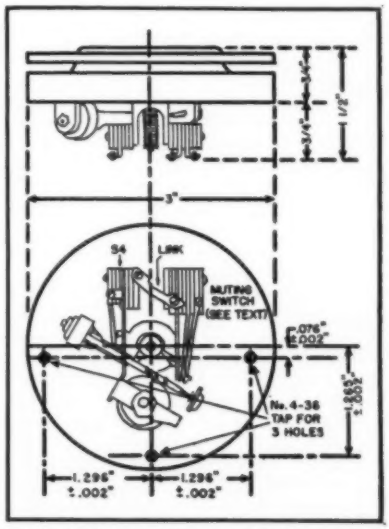
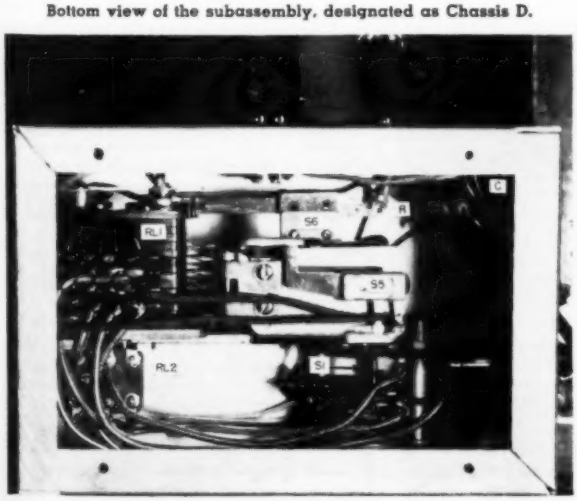
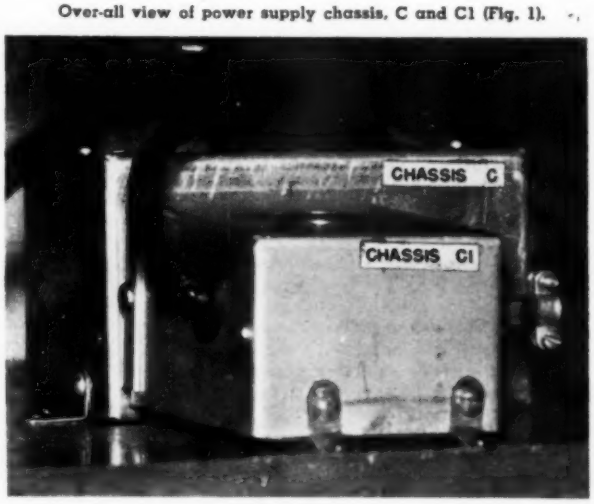


Fig. 2. Mechanical drawing of dial assembly.

Bottom view of the subassembly, designated as Chassis D.



Over-all view of power supply chassis, C and C1 (Fig. 1).



Industrial ELECTRONICS

By
ED BUKSTEIN
Northwestern Vocational Institute

Process and sequence timers have helped to improve the quality of a variety of manufactured products.

THE success of innumerable manufacturing and processing operations depends, to a large extent, on accuracy of timing. In welding, electronic heat treating, x-ray exposure, etc., the quality of results is directly related to precise control of the time during which the product is subjected to the influence of the machine. Many mechanical timing devices involving motor-driven gears and cams have been evolved and used, but none with the same degree of success as electronic timers. Mechanical timers exhibit many shortcomings. They are comparatively slow and inaccurate, and since they employ many moving parts; vibration, wear, and breakdown are common. In timing devices, as in so many other types of apparatus, electronics stands out as the superior method.

Most electronic timers operate by virtue of the fact that when a voltage is applied to a resistor and a condenser in series, a finite and calculable

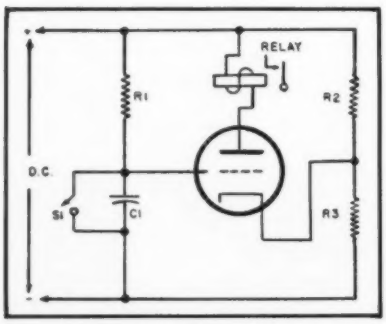


Fig. 1. Basic type of time delay circuit. As the condenser charges, it drives the grid of the tube increasingly positive until the relay in the circuit closes.

time elapses before the condenser becomes fully charged. In some of its variations, the electronic timer involves an initially charged condenser which is subsequently discharged in the required length of time.

Time Delay Circuits

A basic type of time delay circuit is shown in Fig. 1. R_2 and R_3 form a voltage divider across the d.c. supply. That portion of the voltage which appears across R_3 is applied as bias to the cathode of the tube. This bias is sufficient to produce cut-off, so that no plate current flows and the relay is open. The timing interval is initiated by opening switch 1. At this time, C_1 begins to charge through R_1 from the d.c. supply. The positive terminal of the supply attracts electrons from the upper plate of the condenser. At the same time, the negative terminal of the supply repels electrons to the lower plate of the condenser. Since the upper plate of the condenser loses electrons, it, and the grid of the tube which is connected to it, become increasingly positive. After an interval of time, the positive potential on the grid becomes sufficient to overcome the cut-off bias on the cathode. At this time, the tube conducts plate current and the relay closes.

The timing interval is therefore the length of time which elapses between opening of the switch and closing of the relay. The duration of this interval depends upon the values of C_1 and R_1. A larger condenser will require more time to charge, and a larger resistor will slow down the charging rate. Consequently, increasing the value of either C_1 or R_1 will increase the timing interval. Conversely, decreasing C_1 or R_1 will result in a shorter time delay. R_1 is usually made variable to permit control of the timing interval. When a wide range of timing intervals is desired, several different values of condensers and a selector switch may be employed.

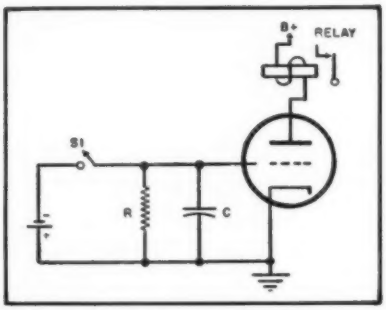


Fig. 2. A time delay circuit which utilizes the discharge time of a condenser. As the condenser discharges through R, the grid becomes less and less negative, the plate current increases, and the relay closes.

Fig. 2 shows a circuit diagram of a time delay circuit in which the discharge time of a condenser is utilized. When the switch is closed, the condenser is charged to the potential of the battery. This charge makes the grid of the tube negative, so that no plate current flows and the relay is open. The timing interval is initiated by opening the switch. Under these conditions, the condenser begins to discharge through the resistor connected across it. As the condenser discharges, the potential on the grid becomes less and less negative. After an interval of time, this negative potential has decreased to the point at which the tube conducts current and the relay closes. The duration of the timing interval is dependent upon the values of C and R.

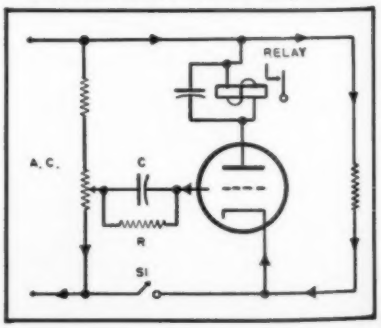
The circuits of Figs. 1 and 2 both require a d.c. source of power. In the interest of simplicity and compactness, a timing circuit which will operate directly from the a.c. power lines is desirable. A circuit which fulfills this requirement is shown in Fig. 3. When the switch is open and the upper power line is negative, electrons flow in the circuit as shown by the arrows. Here, the grid-cathode circuit of the tube is acting as a diode, and the resultant current charges the condenser.

To initiate the time delay, the switch is closed. The tube is now cut off because the charge of the condenser makes its grid negative. However, as the condenser discharges through the resistor connected across it, the grid becomes less negative. After an interval of time determined by the values of R and C, the negative potential on the grid has diminished to the point at which the tube conducts and the relay closes.

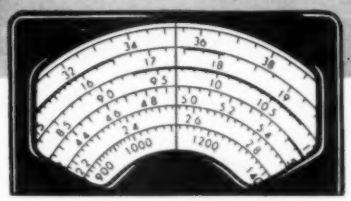
To prevent the relay from opening during the alternations when the plate of the tube is negative, a condenser is connected across its winding. This condenser charges when the tube conducts and discharges through the relay

(*Continued on page* 139)

Fig. 3. A time delay circuit designed to operate directly from the a.c. power line. The grid-cathode circuit acts as a diode to charge the condenser. When switch is closed, the condenser discharges, the grid becomes less negative, and relay closes.



International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

IN THE first DX Contest of the United 49'ers Radio Society, top winners included Gary Ripton, LeRoy, New York, first with 1386 points; Robert Green, Ridgetown, Ontario, Canada, 1287; James R. Pickering, Highstown, N. J., 1024. (Boice, Conn.)

* * *

This Month's Schedules

Albania—Radio Tirana, 6.560 and 7.850, has programs in French 1345-1400 and in *English* 1615-1630. (Radio Sweden) Heard by Pearce, England.

Algeria—Radio Algerie now operates on 7.280 instead of 6.145. (ISWC, London)

Anglo-Egyptian Sudan—Radio Omdurman noted 1225 with news in Arabic on 9.737, 7.385A. (Pearce, England)

Angola—CR6RB, 9.165, Benguela, has weak level in Sweden 1330-1400; often has nice musical session. (Engberg) Noted closing 1400 weekdays with "A Portuguesa" but runs to *after* 1430 Sundays. (Pearce, England) Luanda, 11.862, noted in Newfoundland around 1430-1530. (Peddle) Closes 1730.

Officials of *Radio Diamang*, CR6RG, Dundo, recently reported that of reception reports received, about 40 per-cent have been from Sweden; about 20 percent from Britain, and about 10 percent from Australia. (Radio Australia)

Radio Clube de Huila, Sa da Bandeira 10.050, noted closing 1530; bad CWQRM. (Pearce, England)

Argentina—LRU, 15.29, noted with *English* 2300-0100 sign-off. (Bishop, Ohio) By this time the *English* session 1730-2030 probably will be on 9.69 instead of 17.720.

Radio Splendid, 9.315A, noted at strong level 2245 with Latin American music. (Niblack, Ind.)

Australia—Radio Australia now has a session for Central Europe 1300-1500 on 11.760, 9.580.

Austria—BDN, 9.617, Salzburg, noted 0455. (Pearce, England)

Azores—CSA92, 11.090, Ponta Delgada, still noted in Portuguese 1400-1500. (Kary, Pa.)

Belgian Congo—OTC2, 9.767, now lists QRA as Belgian National Broadcasting Service, P.O. Box 505, Leopoldville, Belgian Congo; sent fine QSL card. (Harris, Ind.) Recently announced over the air that the station will be moved soon to Brussels, Belgium.

Radio Congo Belge, Leopoldville, now uses 11.720 around 1400-1600; has QRM from VOA, Tangier. (Engberg, Sweden) Is heard in Eastern USA.

Bolivia—CP38, 9.497A, La Paz, opens 0555 with "Onward, Christian Soldiers" and identifies in Spanish. (Stark, Texas) *Radio Sweden* lists schedule for this one as Sundays 0655-0815, 1100-2100, weekdays 0555-0730, 0930-1245, 1755-2115 (closing time is only *approximate*).

Brazil—PRL5, 11.950, Rio de Janeiro, noted Saturdays around 1630-1700 with *English* "literary" program, then continuing in Portuguese. (Kary, Pa.) Heard in Sweden at 1500 in Portuguese and *English*. (Engberg)

PSF, 14.687, is noted transmitting prior to scheduled 1730 sign-on; announces "Agencia Nacional;" at 1730 has news in Portuguese which is relayed by all Brazilian commercial stations. (Kary, Pa.) *Radio Sweden* says PRS4. *Radio Cultura da Sao Paulo*, has been heard on 2.470 at 1930-2030.

Radio Inconfidencia, Belo Horizonte, is now using approximately 15.190; weak signal in Sweden from 1500. (Engberg) "Brazil Calling" (*English*) now appears to be aired (at least weekdays) on 11.825 around 1935-1955, and on 9.565 around 2005-2025.

British Guiana—ZFY, 5.980A, Georgetown, noted at good level around 2100. (Cox, Dela.)

British Somaliland—VQ6MI, *Radio Somali*, 7.125, Hargeisa, 1 kw., is on the air 0815-1215, according to a letter from station officials. (Radio Sweden)

Bulgaria—Radio Sofia, 7.671, 6.070, noted with news 1500. (Engberg, Sweden) Also with news 1600. (Pearce, England) Heard on 7.671 at 2340 in Bulgarian. (Cox, Dela.)

Canary Islands—Tenerife, 7.515, noted at fair level from 1600. (Engberg, Sweden)

Cape Verde Island—Praia is noted on 7.110A signing off 1700 in Portuguese. (Engberg, Sweden) Heard by Ferguson, N. C., from 1630 tune-in. Leaves air with "A Portuguesa."

Ceylon—Radio Ceylon, 15.120, noted opening 2045. (Bellington, N. Y.) Relays BBC news 2100.

Chile—CE1515, 15.150, noted recently ending dance music with *English* announcements 1825; continued in Spanish. (Niblack, Ind.) Has nice signal evenings to 2330 closedown.

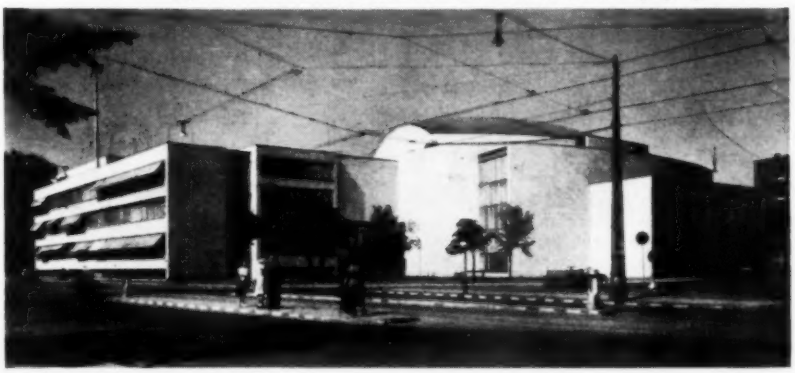
China—WRH lists summer schedule for *Radio Peking's* Overseas Service as 6.100, 1530-1630, 0330-0500, 0800-0830; 9.040, 0400-0430, 0800-0830; 10.260, 1530-1600, 0330-0500, 0800-0830; 11.690, 1530-1600, 1730-2100, 0400-0700, 0730-1030; 15.060, 1530-1600, 1730-2100, 0400-1030; 15.170, 0330-0430, 0800-0830; 7.500, 0330-0400, 0800-0830; *English* at 1730-1800 on 11.69, 15.06; 0400-0430 on 6.100, 9.040, 10.260, 11.690, 15.060, 15.170; 0830-0900 on 11.690, 15.060.

Dilg, Calif., notes Peking fairly good late mornings (*EST*) on 10.200 (this one is *not* announced), 10.260, 11.690, 15.060V; the 9.03A channel also has a fairly good signal at times.

(*Continued on page* 108)

(Note: Unless otherwise indicated, all time is expressed in American EST; add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.) The symbol "V" following a listed frequency indicates "varying." The station may operate either above or below the frequency given. "A" means frequency is approximate.

Programs of the Danish State Radio originate in Radio House in Copenhagen. This modern building provides excellent facilities for both domestic and foreign programs.



Convert Your Signal Generator into a Grid-dip Oscillator

Fig. 1. Three units must be added to the panel of your signal generator if it is to be used as a grid-dip oscillator. Jack J_1, labeled "Probe," is in the upper left-hand corner. S_1, the link switch, is just below and to the right of J_1. J_2 or J_3, depending on the type of indicator used, mounts on the right side of the panel above and to the left of the pilot light.

Add a useful piece of equipment to your test bench at small cost and a nominal expenditure of time.

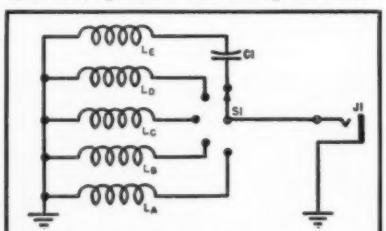
By
HARTLAND B. SMITH, W8VVD

WITHIN recent years a great many hams and service technicians have learned what a useful piece of equipment a grid-dip oscillator can be. Unfortunately, most of the oscillators which have been described in radio magazines or sold in kit form cover only the high frequency ham bands and TV channels. Thus, if one is interested in checking i.f. coils and other low frequency components, he has to build a special unit, just for this purpose.

Despite the circuit simplicity of a grid-dip oscillator, construction and calibration is a rather time-consuming task. Because of this, a lot of radiomen keep putting off the project, thereby depriving themselves of a very worthwhile instrument. Many of these fellows, unknown to themselves, already possess a device which, with the addition of three or four inexpensive parts, can be easily converted into a calibrated, bandswitching grid-dip oscillator capable of tuning from 160 kc. to 50 mc. The basic unit is an r.f. signal generator, several inexpensive versions of which are now on the market. One of these instruments can be changed into a grid-dip oscillator in jig time. What is more, the conversion has little or no effect on the generator's ability to perform its primary job of receiver alignment. Although the changes to be described were made in a *Heath* Model SG-6 signal generator, the process can also be applied to earlier models of the same make or to similar generators produced by other manufacturers.

Most grid-dip oscillators use coils which plug into a socket on the outside of the case. This arrangement makes it relatively easy to couple the oscillator to a circuit under test. Since the coils of the SG-6 are mounted inside the case, some additional means must be provided for transferring r.f. from the oscillator to the resonant circuit being checked. One satisfactory way of accomplishing this is to use link coupling.

Fig. 2. Circuit showing how links are coupled to J_1 by means of the rotary switch, S_1.



C_1—250 μμfd. mica cond. (see text)
J_1—Open circuit jack
S_1—S.p. 5-pos. rotary sw.
L_A—16 t. #28 en. wire. (Link on coil A—160-500 kc.)
L_B—10 t. #28 en. wire. (Link on coil B—500-1600 kc.)
L_C—7 t. #28 en. wire. (Link on coil C—1.6-5.5 mc.)
L_D—5 t. #28 en. wire. (Link on coil D—5.5-18 mc.)
L_E—1 t. #20 hookup wire. (Link on coil E—18-50 mc.)

A probe coil, as shown in the photograph of Fig. 3, is energized by r.f. fed to it through J_1 in Fig. 2, from links wound around the cold ends of the SG-6's coils. Before winding the links, be sure to apply a layer of *Scotch* electrical tape or some other suitable insulation to the coil forms to reduce the possibility of short circuits. Then wind on the prescribed number of turns and apply enough coil dope or cement to hold the links in place.

The proper link is selected by switch S_1 and connected to output jack J_1. The regular output cable test lead plugs into J_1 and carries r.f. from the oscillator to the probe coil. In most cases the probe shown in Fig. 3 can be employed. However, the alligator clips on the signal generator's test lead cable make it a simple matter to change to a coil of different size or shape for use in hard-to-reach spots.

There are two types of indicator which may be employed with the converted signal generator. A vacuum-tube voltmeter can be used to measure grid bias as shown in Fig. 4A, or the grid current may be measured by inserting a meter in series with the grid leak to ground as in Fig. 4B.

Between 160 kc. and 20 mc., the grid bias averages 5 volts and the grid current is in the neighborhood of 200 microamperes. From 20 mc. to 50 mc. the bias is about 1¼ volts and the grid current 50 microamperes. The bias is sufficient to provide plenty of deflection on the low voltage range of a vacuum-tube voltmeter. If you own one of these instruments, I would suggest that you use it for an indicator. Nevertheless, measuring the grid current will prove quite satisfactory if a 0-500 microammeter is employed. A

0-1 milliammeter can be used in a pinch, but because of low grid current it will be rather difficult to read when the unit is operated between 20 mc. and 50 mc.

There are those who may wonder about the advisability of adding links to the SG-6 because of the effect which they may have on the inductance of the coils in the signal generator. Actually, there is only a slight shift in inductance and what frequency change does take place can be fairly well compensated by readjustment of the calibrating trimmer in parallel with the main tuning condenser.

On the author's particular signal generator, with the links in place, the average accuracy of the dial readings is within .75%. The highest error is only about 2.2%, while many points are within .5% or better. These checks were made with switch S_1 set on band "A" (160 kc. — 500 kc.), and with the test lead plugged into the regular r.f. output jack. For greatest accuracy, S_1 should always be left in position "A" when the SG-6 is operated as a signal generator. Accuracy of the instrument when used as a grid-dip oscillator will depend upon how tightly the probe coil is coupled to the circuit being tested. The least amount of coupling will produce the most nearly correct dial reading.

When a grid-dip oscillator is constructed, a portion of the circuit sometimes resonates at one particular frequency and whenever the oscillator is tuned past this frequency, a pronounced dip in grid current occurs. The unwanted dip can prove quite annoying if it happens to fall in a range where you expect to do very much testing. The only resonance of this nature which showed up in the SG-6 landed right smack in the middle of the 10 meter band. The distributed capacity of the test lead was tuning the link on the 20 mc. to 50 mc. coil. The purpose of condenser C_1, placed in series with L_{2L} is to raise the unwanted resonance to around 40 mc., a test frequency which is not often used. The lower the capacity of C_1, the higher will be the frequency of the spurious dip. C_1 cannot be made too small, though, or it will reduce the sensitivity of the oscillator on the 20-50 mc. range. 250 $\mu\mu$fd. appears to be the most practical value.

The panel of the SG-6 is so filled with controls that there is little room for mounting the required jacks and switch. While the placement of these items might not please an esthete, I am convinced that the advantage of having a grid dip oscillator on hand far outweighs the slight panel unbalance resulting from the necessary additions.

After the conversion has been completed, plug the test lead into link jack, J_1, and attach the alligator clips to the probe coil. Clip the ground lead from the vacuum-tube voltmeter to the metal handle on the case of the SG-6 and plug the d.c. prod into J_2. If a microammeter dip indicator is to be used in place of a v.t.v.m., it should be plugged into J_2. Couple the probe coil closely to any resonant circuit you wish to test and tune the signal generator until the indicator shows a pronounced dip. If no dip can be found on one band, change to another, making certain that both S_1 and the bandswitch are always on the same frequency range.

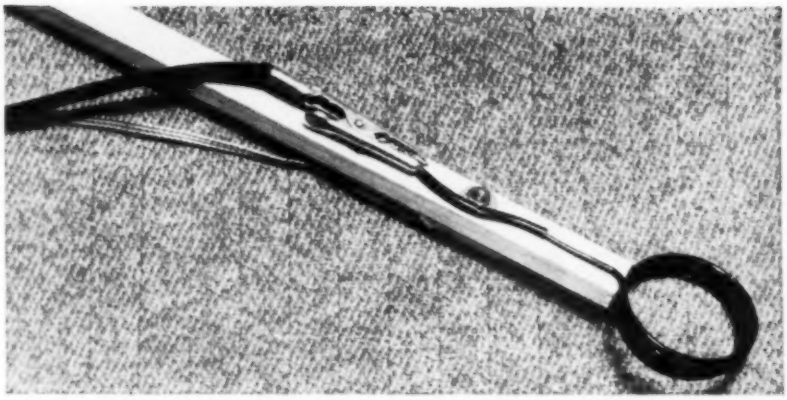


Fig. 3. Over-all view of probe coil. The unit consists of 6 turns of No. 14 enamel wire, 1⅜" in diameter. After the turns are cemented together, the coil is cemented to the end of a wooden handle. The leads are fastened to soldering lugs mounted on the handle by means of 6-32 machine screws. Alligator clips on signal generator's output test lead attach to the lugs and energize the coil with r.f.

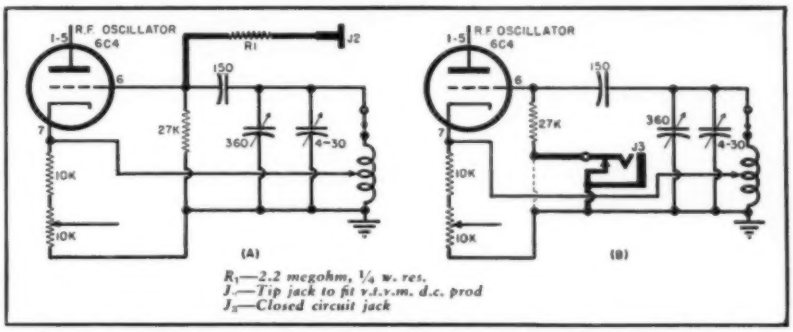


Fig. 4. Wiring changes for two versions of the grid-dip oscillator. (A) Circuit for use in conjunction with a v.t.v.m. The d.c. prod of the voltmeter should be plugged into J_2 and the meter's ground lead clipped to the signal generator's metal handle. (B) Added parts and wiring are shown in heavy lines, deletions are dotted. If a microammeter indicator is employed, it is plugged into J_2 of the circuit.

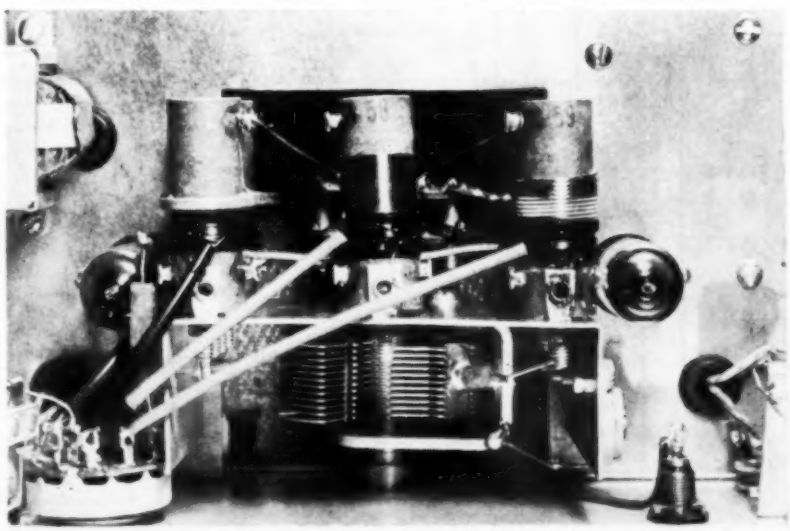


Fig. 5. A layer of "Scotch" electrical tape is put over the ground ends of the oscillator coils before the links are wound, thus preventing shorts between units.

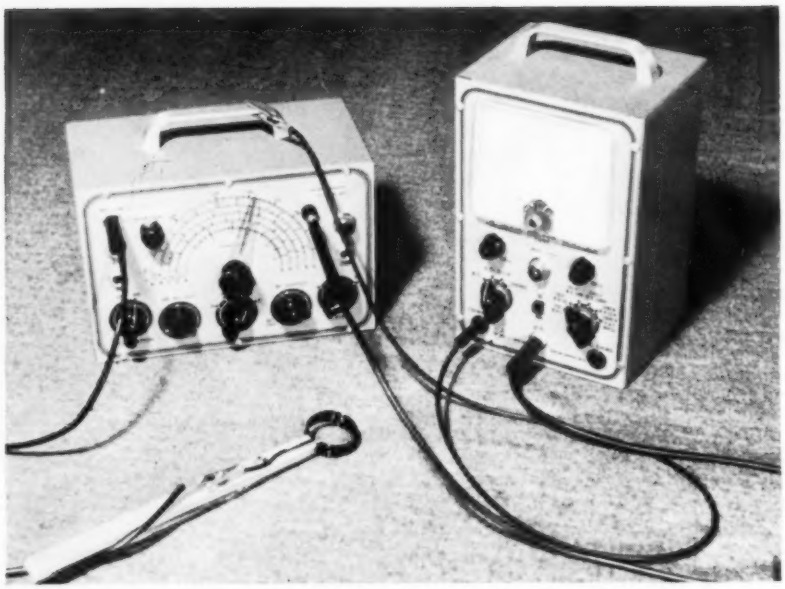


Fig. 6. Converted signal generator. Output test lead is plugged into J_1 and its alligator clips are attached to probe coil. The d.c. probe of v.t.v.m., used as a dip indicator, is plugged into J_2. Ground lead is clipped to handle of generator.

When resonance is finally encountered, move the probe coil away until the dip is barely perceptible. The dial reading of the signal generator will then closely approximate the resonant frequency of the circuit being tested. In most cases the accuracy of the dial will be adequate. However, if you desire a more exact check, tune in the signal from the oscillator on an accurately-calibrated, all-wave receiver.

The highest frequency band of the SG-6 is calibrated for both its fundamental range and for its third harmonic. Since a grid-dip oscillator only functions on the fundamental, the top frequency of the SG-6 when used as a grid-dip oscillator is restricted to 50 mc., even though the dial reads to 150 mc.

The principal use of a grid-dip oscillator is in finding the resonant frequencies of tuned circuits. In addition, if the value of either the inductance or the capacitance of the circuit under test is known the value of the other component may be calculated by means of the following formulas.

If C is known: $L = 25{,}330/CF^2$ or if L is known: $C = 25{,}330/LF^2$ where L is the inductance in microhenrys, C is the capacitance in micromicrofarads, and F is the frequency at which dip occurs.

If mathematical computations are as distasteful to you as they are to me, you can obtain painless solutions to these formulas by using either a *"Shure* Reactance Slide Rule" or an *"Allied* Rapid R.F. Resonance and Coil Winding Calculator." [1]

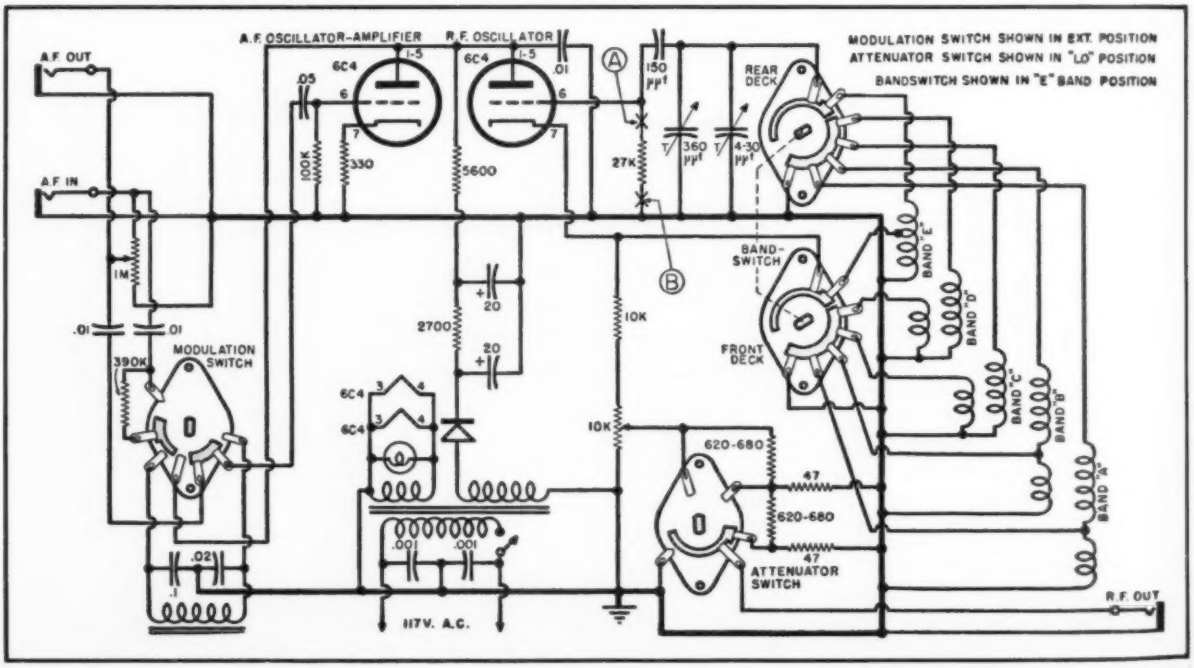
In conclusion, it would be well to again point out that this circuit can be added to almost any signal generator and is not confined to the *Heath* unit alone. The author happened to have the *Heath* Model SG-6 on his test bench so the circuit was worked out using the *Heath* circuit and panel layout as the model. For your particular signal generator, a few alterations will be required.

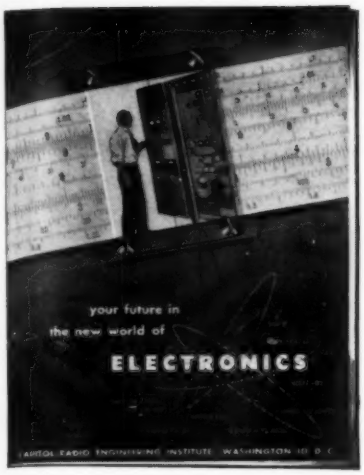
The slight investment in time and parts required for the conversion will begin to pay off the moment construction has been completed. Until there is an all-wave grid-dip oscillator available on your work bench you'll never realize how much time can be saved when ancient trial and error methods of resonance checking are tossed into the wastebasket. Besides, the ability to check values of unmarked condensers, i.f. coils, etc., is an added dividend which must not be discounted. Convert your signal generator and I am certain you'll be pleased with the results.

—30—

[1] *Allied Radio Corp., 833 W. Jackson Blvd., Chicago, Ill. 37-995. 35c postpaid.*

Fig. 7. Schematic diagram of the Heath Model SG-6 signal generator. Points "A" and "B" correspond to Figs. 4A and 4B. The probe coils shown in Fig. 2 are air-coupled to the band coils shown on right-hand side of diagram as "Band A," "Band B," etc.





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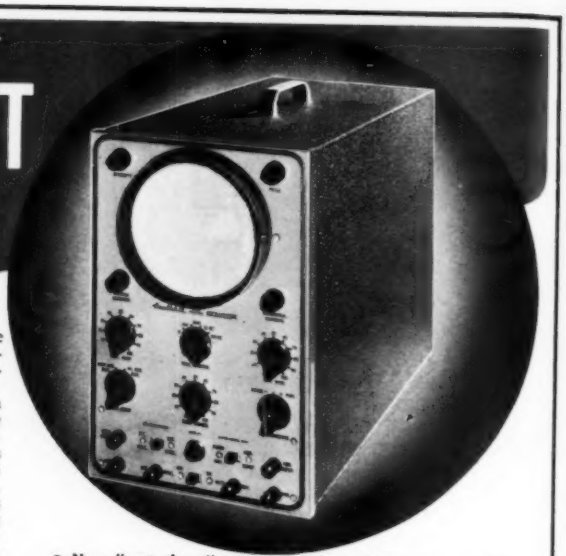

The Heathkit 0-7 Oscilloscope with its 10 tube lineup (including CR tube) and carefully engineered circuit using highest quality components is truly the most outstanding scope value on the market today.

The "spot shape" (astigmatism) control working in conjunction with the focus control assures clear, sharp focusing . . . extended sweep range and faster retrace time permits the study of high frequencies . . . step-attenuated frequency-compensated cathode follower vertical input contributes to the excellent frequency response of the vertical channel . . . .03V RMS per inch vertical sensitivity makes weak input signals easy to study . . . push-pull operation of both vertical and horizontal deflection plates reduces pattern distortion . . . specially designed extra-wide CR tube mounting bracket places vertical cascade amplifier, vertical phase splitter, and deflection amplifiers near base of CR tube to reduce distributed wiring capacity and increase high frequency response.

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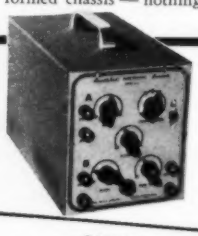

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A signal voltage anywhere between 2 and 300V can be fed directly into the instrument and a change in signal voltage between these limits will not affect the meter reading. In addition, input wave shape is not critical (the unit will read the frequency of either sine wave or square wave input).

The tube complement consists of a 6SJ7 amplifier and clipper, 6V6 amplifier and clipper, 6H6 meter pulse rectifier, 6X5 power supply rectifier, and OD3/VR150 voltage regulator.

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- **New styling, — formed case for beauty.**
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- **Quality 200 microamp meter.**
- **New ohms battery holding clamp and spring clip — assurance of good electrical contact.**
- **Highest quality precision resistors in multiplier circuit.**
- **Calibrates on both AC and DC for maximum accuracy.**
- **Terrific coverage — reads from ½V to 1000V AC, ½V to 1000V DC, and .1 to over 1 billion ohms resistance.**
- **Large, clearly marked meter scales indicate ohms, AC Volts, DC Volts, and DB — has zero set mark for FM alignment.**

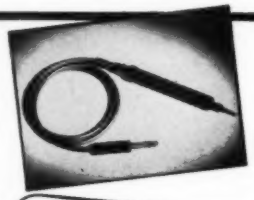
Designed to take up a minimum of space, yet designed to be the most important and useful instrument on your workbench. Really handsome looking — note the rounded edges on front panel and rear cover. New compact size has cabinet dimensions of only 4⅛" deep x 4 11/16" wide x 7⅜" high.

Tremendous coverage — will read from ½V to 1000V AC, ½V to 1000V DC, .1 to over 1 billion ohms resistance, and Db. Meter scale has zero-set mark for FM alignment — all scales clearly marked for easy and fast readings and Db scale is in red for easy identification.

Simple to operate. Ohms adjust and zero adjust controls located on front panel along with selector and range switches. Selector switch has four positions: AC. DC−, DC+ and Ohms to set up the instrument for type of reading desired. DC− position allows negative voltages to be taken without reversing test prods. AC and DC voltage ranges are full scale 3V — 10V — 30V — 100V — 300V — 1000V and resistance ranges are RX1, X10, X100, X1000, X10M, X1 Megohm. Convenient ranges for fast and accurate readings.

Strictly highest quality components used throughout — 1% precision resistors in multiplier circuit, Simpson 200 microampere meter movement, sturdy cabinet, excellent positive detent smooth acting switches, etc. New miniature tube used in meter balancing circuit and new battery holding clamp and spring clip assure good contact to ohms string of resistors.

Kit comes complete — and the instruction manual with its step-by-step instructions, pictorials, figures, and schematic makes assembly a pleasure.



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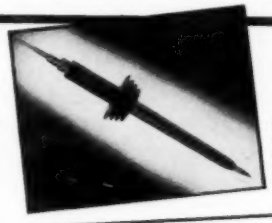

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The ingenious circuitry incorporates precision multiplied resistors for accuracy, two amplifier stages using miniature tubes, a unique bridge rectifier meter circuit, quality Simpson meter with 200 microampere movement, and a clean layout of parts for easy wiring. A high degree of inverse feedback provides for stability and linearity.

Extremely compact, cabinet size — 4-1/8" deep x 4-11/-16" wide x 7-3/8" high. Newly designed cabinet makes this the companion piece to the VTVM.

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The Heathkit Square Wave Generator is an excellent square wave frequency source with features you won't want to be without. Especially notable is the wide range of the instrument — 10 cycles to 100 kilocycles continuously variable. This wide range makes it useful for television and wide band amplifier work as well as audio experimentation. The output impedance is low, and the output voltage is continuously variable between 0 and 20 volts. Because a multivibrator stage cannot be accurately calibrated, terminals on the front panel can be used for synchronization to an external source should it be desired.

The circuitry consists of a multivibrator stage, a clipping and a squaring stage, and a cathode follower output stage. The power supply is transformer operated and utilizes a full wave rectifier tube with 2 sections of LC filtering.

For a good, wide range, and low priced square wave generator, the SQ-1 just can't be beat.

MODEL SQ-1
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SIGNAL GENERATOR KIT

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The new Heathkit Signal Generator Kit has dozens of improvements. Covers the extended range of 160 Kc to 50 megacycles on fundamentals and up to 150 megacycles on useful calibrated harmonics; makes this Heathkit ideal as a marker oscillator for TV. Output level can be conveniently set by means of both step attenuator and continuously variable output controls. Instrument has new miniature HF tubes to easily handle the high frequencies covered.

Uses 6C4 master oscillator and 6C4 sine wave audio oscillator. The kit is transformer operated and a husky selenium rectifier is used in the power supply. All coils are precision wound and checked for calibration making only one adjustment necessary for all bands.

New sine wave audio oscillator provides internal modulation and is also available for external audio testing. Switch provided allows the oscillator to be modulated by an external audio oscillator for fidelity testing of receivers. Comes complete, all tubes, cabinet, test leads, every part. The instruction manual has step-by-step instructions and pictorials. It's easy and fun to build a Heathkit Model SG-6 Signal Generator.

Heathkit

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The kit is 110V 60 cycle transformer operated and comes complete with rectifier tube, magic eye tube, cabinet, calibrated panel and all other parts. Has clear detailed instructions for assembly and use.

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Heathkit

TUBE CHECKER KIT

The Tube Checker is a MUST for radio repair men. Often customers want to SEE tubes checked, and a checker like this builds customer confidence. In your repairing, you will have a multitude of tubes to check — quickly. The Heathkit tube checker will serve all these functions — it's good looking (with a polished birch cabinet and an attractive two color panel) — checks 4, 5, 6, 7 prong Octals, Loctals, 7 prong miniatures, 9 prong miniatures, pilot lights, and the Hytron 5 prong types. AND IT'S FAST TO OPERATE — the gear driven, free-running roll chart lists hundreds of tubes, and the smooth acting, simplified switching arrangement gives really rapid set-ups.

The testing arrangement is designed so that you will be able to test new tubes of the future — without even waiting for factory data — protection against obsolescence.

You can give tubes a thorough testing — checks for opens, shorts, each element individually, emission, and for filament continuity. A large BAD-?-GOOD meter scale is in three colors for easy reading and also has a "line-set" mark.

You'll find this tube checker kit a good investment — and it's only $29.50.

YOU SAVE BY ORDERING DIRECT FROM MANUFACTURER—USE ORDER BLANK ON LAST PAGE

ROCKE INTERNATIONAL CORP.
13 E. 40th ST.
NEW YORK CITY (16)

The HEATH COMPANY
. . . BENTON HARBOR 15, MICHIGAN

NEW 1952 *Heathkit*

BATTERY ELIMINATOR KIT

$24.50

Model BE-3
Shipping Wt. 17 lbs.

- **Can be used as battery charger.**
- **Continuously variable output 0 - 8 Volts — not switch type.**
- **Heavy duty Mallory 17 disk type magnesium copper sulfide rectifier.**
- **Automatic overload relay for maximum protection. Self-resetting type.**
- **Ideal for battery, aircraft and marine radios.**
- **Dual Volt and Ammeters read both voltage and amperage continually — no switching.**

The new Heathkit Model BE-3 incorporates the best. Continuously variable output control is of the variable transformer type with smooth wiper type contacts.

There are no switches or steps and voltage between 0 and 8 Volts is available at 10 Amperes continuous and 15 Amperes intermittent. Maximum safety from overloads and shorts provided by automatic overload relay which resets itself when overload is removed.

The new rectifier is a 17 plate Mallory magnesium copper sulfide type. This is the most rugged type available for long trouble-free use.

Output is continuously metered by both a 0 - 10 Volt Voltmeter and a 0 - 15 Amp Ammeter. Shorted vibrators indicated instantly by ammeter.

Equip now for all types of service — aircraft — marine — auto and battery radios — this inexpensive instrument vastly increases service possibilities — better be ready when the customer walks in.

NEW *Heathkit*

SINE AND SQUARE WAVE AUDIO GENERATOR KIT

Model AG-7
Shipping Wt. 15 lbs.

$34.50

Designed with versatility, usefulness, and dependability in mind, the AG-7 gives you the two most needed wave shapes right at your fingertips — the sine wave and the square wave.

The range switch and plainly calibrated frequency scale give rapid and easy frequency selection, and the output control permits setting the output to any desired level.

A high-low impedance switch sets the instrument for either high or low impedance output —on high to connect a high impedance load, and on low to work into a low impedance transformer with negligible DC resistance.

Coverage is from 20 to 20,000 cycles, and distortion is at a minimum — you can really trust the output wave shape.

Six tubes, quality 4 gang tuning condenser, power transformer, metal cased filter condenser, 1% precision resistors in the frequency determining circuit, and all other parts come with the kit —plus, a complete construction manual — A tremendous kit, and the price is truly low.

THE NEW *Heathkit*

HANDITESTER KIT

$13.50

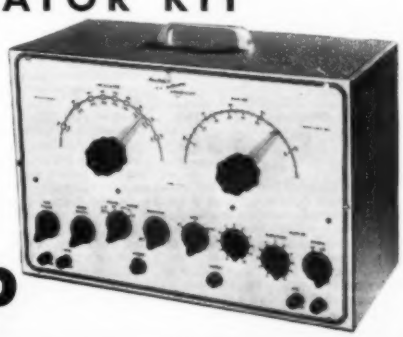
Model M-1
Shipping Wt. 3 lbs.

A precision portable volt-ohm milliammeter. Uses only high quality parts — All precision 1% resistors, three deck switch for trouble-free mounting of parts, specially designed battery mounting bracket, smooth acting ohm adjust control, beautiful molded bakelite case, 400 micro-amp meter movement, etc.

DC and AC voltage ranges 10 - 30 - 300 - 1000 - 5000V. Ohms range 0 - 3000 and 0 - 300,000. Range Milliamperes 0 - 10 Ma, 0 - 100 Ma. Easily assembled from complete instructions and pictorial diagrams.

NEW *Heathkit*

T.V. ALIGNMENT GENERATOR KIT



Model TS-2
Shipping Wt. 20 lbs.

$39.50

Here is an excellent TV Alignment Generator designed to do TV service work quickly, easily, and properly. The Model TS-2 when used in conjunction with an oscilloscope provides a means of correctly aligning television receivers.

The instrument provides a frequency modulated signal covering, in two bands, the range of 10 to 90 Mc. and 150 to 230 Mc.— ALL ALLOCATED TV CHANNELS AS WELL AS IF FREQUENCIES ARE COVERED.

An absorption type frequency marker covers from 20 to 75 Mc. in two ranges—therefore, you have a simple, convenient means of frequency checking of IF's, independent of oscillator calibration.

Sweep width is controlled from the front panel and covers a sweep deviation of 0-12 Mc.—all the sweep you could possibly need or want.

And still other excellent features are: Horizontal sweep voltage available at the front panel (and controlled with a phasing control—both step and continuously variable attenuation for setting the output signal to the desired level—a convenient instrument stand-by position—vernier drive of both oscillator and marker tuning condensers—and blanking for establishing a single trace with base reference level. Make your work easier, save time, and repair with confidence—order your Heathkit TV Alignment Generator now!

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NEW YORK CITY (16)

The HEATH COMPANY
. . . BENTON HARBOR 15, MICHIGAN

Heathkit

SIGNAL GENERATOR KIT

Model SG-6
Shipping Wt. 7 lbs.

$19.50

The new Heathkit Signal Generator Kit has dozens of improvements. Covers the extended range of 160 Kc to 50 megacycles on fundamentals and up to 150 megacycles on useful calibrated harmonics; makes this Heathkit ideal as a marker oscillator for TV. Output level can be conveniently set by means of both step attenuator and continuously variable output controls. Instrument has new miniature HF tubes to easily handle the high frequencies covered.

Uses 6C4 master oscillator and 6C4 sine wave audio oscillator. The kit is transformer operated and a husky selenium rectifier is used in the power supply. All coils are precision wound and checked for calibration making only one adjustment necessary for all bands.

New sine wave audio oscillator provides internal modulation and is also available for external audio testing. Switch provided allows the oscillator to be modulated by an external audio oscillator for fidelity testing of receivers. Comes complete, all tubes, cabinet, test leads, every part. The instruction manual has step-by-step instructions and pictorials. It's easy and fun to build a Heathkit Model SG-6 Signal Generator.

Heathkit

CONDENSER CHECKER KIT

Only

$19.50

Model C-2
Shipping Wt. 6 lbs.

Checks all types of condensers — paper — mica — ceramic — electrolytic. All condenser scales are direct reading and require no charts or multipliers. Covers range of .00001 MFD to 1000 MFD. A Condenser Checker that anyone can read. A leakage test and polarizing voltage for 20 to 500 V provided. Measures power factor of electrolytics between 0% and 50% and reads resistance from 100 ohms to 5 megohms. The magic eye indicator makes testing easy.

The kit is 110V 60 cycle transformer operated and comes complete with rectifier tube, magic eye tube, cabinet, calibrated panel and all other parts. Has clear detailed instructions for assembly and use.

NEW *Heathkit*

SIGNAL TRACER AND UNIVERSAL TEST SPEAKER KIT

$19.50

Model T-2
Shipping Wt. 7 lbs.

The popular Heathkit Signal Tracer has now been combined with a universal test speaker at no increase in price. The same high quality tracer follows signal from antenna to speaker — locates intermittents — finds defective parts quicker — saves valuable service time — gives greater income per service hour. Works equally well on broadcast, FM, or TV receivers. The test speaker has an assortment of switching ranges to match either push-pull or single output impedances. Also tests microphones, pickups and PA systems. Comes complete: cabinet, 110V 60 cycle power transformer, tubes, test probe, all necessary parts, and detailed instructions for assembly and use.

Model TC-1
Shipping Wt. 12 lbs.

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$13.50

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Shipping Wt. 3 lbs.

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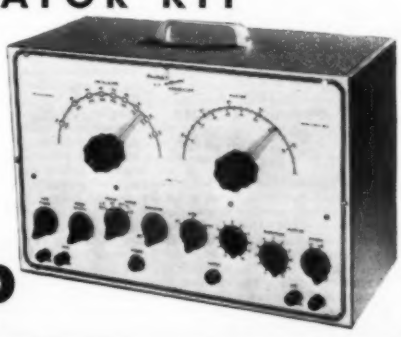

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Model TS-2
Shipping Wt. 20 lbs.

$39.50

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The **HEATH COMPANY**

. . . BENTON HARBOR 15, MICHIGAN

Heathkit IMPEDANCE BRIDGE KIT

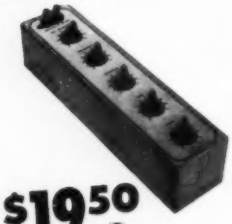
Model 18-18
Shipping Wt. 15 lbs.

$69.50

This Impedance Bridge Kit is really a favorite with schools, industrial laboratories, and serious experimenters. An invaluable instrument for those doing electrical measurements work. Reads resistance from .01 Ohms to 10 meg., capacitance from .00001 to 100 MFD, inductance from 10 microhenries to 100 henries, dissipation factor from .002 to 1, and storage factor from 1 to 1000. And you don't have to worry about selecting the proper bridge circuit for the various measurements — the instrument automatically makes the correct circuit when you set up for taking the measurement you want. Bridge utilizes Wheatstone, Hay, Maxwell, and capacitance comparison circuits for the wide range and types of measurements possible. And it's self powered — has internal battery and 1000 cycle hummer. No external generator required — has provisions for external generator if measurements at other than 1000 cycles are desired. Kit utilizes only highest quality parts. General Radio main calibrated control. Mallory ceramic switches, excellent 200 microamp zero center galvanometer, laboratory type binding posts with standard ¾ inch centers, 1% precision ceramic-body type multiplier resistors, beautiful birch cabinet and ready calibrated panel. (Headphones not included.)

Take the guesswork out of electrical measurements — order your Heathkit Impedance Bridge kit today — you'll like it.

Heathkit LABORATORY RESISTANCE DECADE KIT



$19.50
Shipping Wt. 4 lbs.

An indispensable piece of laboratory equipment — the Heathkit Resistance Decade Kit gives you resistance settings from 1 to 99,999 ohms IN ONE OHM STEPS. For greatest accuracy, 1% precision ceramic-body type resistors and highest quality ceramic wafer switches are used.

Designed to match the Impedance Bridge above, the Resistance Decade Kit has a beautiful birch cabinet and attractive panel. It's easy to build, and comes complete with all parts and construction manual.

Heathkit LABORATORY POWER SUPPLY KITS

Limits:

No load	Variable	150-400V DC
25 MA	Variable	30-310V DC
50 MA	Variable	25-250V DC

Higher loads: Voltage drops off proportionally

$29.50
Model PS-1.....Ship. Wt. 20 lbs.

Every experimenter needs a good power supply for electronic setups of all kinds. This unit has been expressly designed to act as a HV supply and a 6.3 V filament voltage source. Voltage control allows selection of HV output desired (continuously variable within limits outlined), and a Volts-Ma switch provides choice of output metering. A large plainly marked and direct reading meter scale indicates either DC voltage output in Volts or DC current output in Ma. (Range of meter 0-500V D.C., 0-200 Ma. D.C.). Instrument has convenient stand-by position and pilot light.

Comes with power transformer, filament transformer, meter, 5Y3 rectifier, two 1619 control tubes, completely punched and formed chassis, panel, cabinet, detailed construction manual, and all other parts to make the kit complete.

Heathkit ECONOMY . . . 6 WATT AMPLIFIER KIT

MODEL A-7
Shipping Wt. 8 lbs.

$14.50

- **Choice of 4-8-15 ohm output impedances.**
- **Response flat ± 1½ db from 20—20,000 cycles.**
- **6 watts output.**
- **Good fidelity at low cost.**
- **Output tubes working in push pull.**
- **Volume, bass, and treble controls.**
- **Two separate inputs.**

The purpose of this kit is to provide to the kit builder a low cost amplifier with excellent fidelity. The circuit consists of four tubes with following functions: a 12SL7, one section working as an amplifier and one as a phase splitter, two 12A6 output tubes working in push pull, and a 5Y3 rectifier in a full wave rectifier circuit.

The unit operates from a husky power transformer, and has good output transformer with a choice of 4—8—15 ohm output impedances. (Speaker not included).

The kit provides excellent listening pleasure and the price is really low. Compare it with all others. You won't find a better buy.

MODEL A-7: For tuner and crystal phono inputs. Has two position selector switch for convenient switching to type of input desired.

Model A-7-A: Has a 12SH7 preamplifier stage with special compensation network for operation with reluctance phono input.
Shipping Wt. 8 lbs.....**$16.50**

Heathkit HIGH FIDELITY 20 WATT AMPLIFIER KIT

MODEL A-8
Shipping Wt. 18 lbs.

$33.50

The A8 (or A-8A) is a high quality amplifier for those who want high fidelity output at moderate cost. Frequency response within ± 1db from 20-20,000 cycles. Distortion at 3db below maximum power output (at 1,000 cycles) is only .8%. Kit has a Chicago power transformer in drawn steel case and a Peerless output transformer with output impedances of 4—8—16 ohms. Bass and treble controls permit listener to select output with tonal qualities of his own liking.

The tube lineup is composed of a 6SJ7 voltage amplifier, a 6SN7 amplifier and phase splitter, two 6L6's in push-pull output and a 5U4G rectifier. All parts furnished (speaker not included) and the construction manual makes assembly easy.

MODEL A-8: For tuner and crystal phono inputs. Has two position selector switch for convenient switching to type of input desired.

MODEL A-8A: Features an added 6SJ7 stage (preamplifier) for operating from variable reluctance cartridge phono pickup, mike input, and either tuner or standard crystal phono pickup. A three position selector switch provides flexible switching. Shipping Wt. 18 lbs.....**$35.50**

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The HEATH COMPANY
. . . BENTON HARBOR 15, MICHIGAN

Heathkit RECEIVER & TUNER KITS for AM and FM

$19.50

Model BR-1 Broadcast Model Kit covers 550 to 1600 Kc. Shipping Wt. 10 lbs.

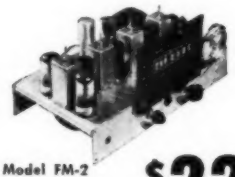
Model AR-1 3 Band Receiver Kit covers 550 Kc. to over 20 Mc. continuous. Extremely high sensitivity. Shipping Wt. 10 lbs.

$23.50

TWO HIGH QUALITY Heathkit SUPERHETERODYNE RECEIVER KITS

Two excellent Heathkits. Ideal for schools, replacement of worn out receivers, amateur and custom installations.

Both are transformer operated quality units. The best of materials used throughout — six inch calibrated slide rule dial — quality power output transformers — dual iron core shielded. I.F. coils — metal cased filter condenser. The chassis has phono input jacks, 110 Volt output for phono motor and there is a phono-radio switch on panel. A large metal panel simplifying installation in used console cabinets is included. Comes complete with tubes and instruction manual incorporating pictorials and step-by-step instructions (less speaker and cabinet). The three band model has simple coil turret which is assembled separately for ease of construction.



Model FM-2
Ship. Wt. 9 lbs.

$22.50

TRUE FM FROM Heathkit FM TUNER KIT

The Heathkit FM Tuner Model FM-2 was designed for best tonal reproduction. The circuit incorporates the most desirable FM features — true FM.

Utilizes 8 tubes: 7E5 Oscillator, 6SH7 mixer, two 6SH7 IF amplifiers, 6SH7 limiter, two 7C4 diodes as discriminator, and 6X5 rectifier.

The instrument is transformer operated making it safe for connection to any type receiver or amplifier. Has ready wound and adjusted RF coils, and 2 stages of 10.7 Mc IF (including limiter). A calibrated six inch slide rule dial has vernier drive for easy tuning. All parts and complete construction manual furnished.

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BENTON HARBOR 15,
MICHIGAN

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	Heathkit VTVM Kit — Model V-5-A			Heathkit R.F. Signal Gen. Kit — Model SG-6	
	Heathkit FM Tuner Kit — FM-2			Heathkit Condenser Checker Kit — Model C-2	
	Heathkit Broadcast Receiver Kit — Model BR-1			Heathkit Handitester Kit — Model M-1	
	Heathkit Three Band Receiver Kit—Model AR-1			Heathkit Power Supply Kit — Model PS-1	
	Heathkit Amplifier Kit — Model A-7 (or A-7-A)			Heathkit Resistance Decade Kit — Model RD-1	
	Heathkit Amplifier Kit — Model A-8 (or A-8A)			Heathkit Impedance Bridge Kit — Model IB-1B	
	Heathkit Tube Checker Kit — Model TC-1			Heathkit A.C. VTVM-KIT — Model AV-1	
	Heathkit Audio Generator Kit — Model AG-7			Heathkit Intermodul. Analyzer Kit—Model IM-1	
	Heathkit Battery Eliminator Kit — Model BE-3			Heathkit Audio Freq. Meter Kit — Model AF-1	
	Heathkit Electronic Switch Kit — Model S-2			Heathkit Square Wave Gen. Kit — Model SQ-1	
	Heathkit T.V. Alignment Gen. Kit — TS-2				
	Heathkit Signal Tracer Kit — Model T-2				
	Heathkit R.F. Probe Kit — No. 309				

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On Express Orders, do not include transportation charges — they will be collected by the Express Agency at time of delivery.

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What's New in Radio

For additional information on any of the items described herein, readers are asked to write direct to the manufacturer. By mentioning RADIO & TELEVISION NEWS, the page, and the issue number, delay will be avoided.

CRAFTSMEN AMPLIFIER

The Radio Craftsmen, Inc., 4401 N. Ravenswood Avenue, Chicago 40, Illinois has introduced a new high-fidelity audio amplifier which has been designed for custom installations.

The *Craftsmen* 400 circuit features a direct-coupled, split-load triode

phase inverter driving push-pull 6V6 power output tubes. Use of 13½ db inverse feedback around the entire amplifier results in a 4:1 output damping factor or an output internal impedance of 2 ohms at the 8 ohm tap.

Specifications on the 400 include a response of ± 1 db from 15 to 20,000 cps at 10 watts output; total harmonic distortion of less than 1% at 10 watts output; intermodulation distortion of less than 5% at 10 watts (60 and 7000 cps, 4:1); frequency response of ± 1 db from 10 to 30,000 cps at ½ watt; and a hum and noise level 70 db below the rated output. 4, 8, and 16 ohm speaker outputs are provided. The entire unit measures 14" x 4½" x 5¼".

TAPE RECORDERS

Masco Electronic Sales Corporation of 32-28 49th Street, Long Island City 3, New York has announced six new tape recorders which feature fast forward speeds and new duo-motor drives.

Of the six models the 52R, 52LR, and 52CR have a built-in AM tuner; the 52 and 52R have a carrying case; the 52C and 52CR have a self-contained metal cover; and the 52L and 52LR have no covers.

All of the units have dual speed 3.75 or 7.5 inches per second, with automatic amplifier equalization for each speed. The dual-track feature permits up to 2 hours of recording on a seven-inch reel. In conjunction with the duo-motor drive there is a separate idler take-up mechanism for lowest wow and flutter.

Complete specifications on this new series are available from the company on request.

FOLDED-HORN ENCLOSURE

Electro-Voice, Inc., Buchanan, Michigan is now marketing a moderately-priced folded-horn corner enclosure which has been designed for use with the *E-V* SP8-B or SP8-BT 8" speaker or any other 8" loudspeaker.

Utilizing the Klipsch principle of folded corner horn loading, the "Baronet" conceals in approximately 1½ cubic feet of furniture housing the

throat of a horn formed by the walls of the room itself.

The new unit measures 23½" high, 14½" wide, and 10½" deep at the top and 14½" deep at the bottom. The enclosure is available in mahogany and blonde finishes. For complete details on the "Baronet" write direct to the company.

TEST INSTRUMENT

Precise Development Corp., Oceanside, New York has released a new test instrument in its line, the Model 635 universal a.f. sine, square, and pulse generator.

Designed to facilitate audio and video troubleshooting, the new unit features a Wien bridge oscillator; provides sine waves, square waves, and pulses; has a variable impedance, cathode-follower output; voltage regulation to insure a constant output; minimum overshoot and round-off through 30,000 cycles on square waves and pulses; sine waves through 200,000

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TO TRAIN AND COACH YOU AT HOME IN SPARE TIME UNTIL YOU GET

YOUR FCC LICENSE

If you have had any practical experience—Amateur, Army, Navy, radio repair, or experimenting.

Ours is the only home study course which supplies FCC-type examinations with all lessons and final tests.

TELEVISION ENGINEERING included in our Training and Coaching

TELLS HOW—

OUR AMAZINGLY EFFECTIVE JOB-FINDING SERVICE HELPS CIRE STUDENTS GET BETTER JOBS. HERE ARE JUST A FEW RECENT EXAMPLES OF JOB-FINDING RESULTS:

GETS CIVIL SERVICE JOB

"Thanks to your course I obtained my 2nd phone license, and am now employed by Civil Service at Great Lakes Naval Training Station as an Equipment Specialist."
Kenneth R. Leiser, Fair Oaks, Mtd. Del., McHenry, Ill.

GETS STATE POLICE JOB

"I have obtained my 1st class ticket (thanks to your school) and since receiving same I have held good jobs at all times. I am now Chief Radio Operator with the Kentucky State Police." Edwin Healy, 264 E. 3rd St., London, Ky.

GETS BROADCAST JOB

"I wish to thank your Job-Finding Service for the help in securing for me the position of transmitter operator here at WCAE, in Pittsburgh."
Walter Koschik, 1442 Ridge Ave., N. Braddock, Pa.

GETS AIRLINES JOB

"Due to your Job-Finding Service, I have been getting many offers from all over the country, and I have taken a job with Capital Airlines in Chicago, as a Radio Mechanic."
Harry Clare, 4537 S. Drexel Blvd., Chicago, Ill.

TELLS HOW—

EMPLOYERS MAKE JOB OFFERS LIKE THESE TO OUR GRADUATES EVERY MONTH!

Letter from Chief Engineer, Broadcast Station, North Carolina. "Need men with radiotelephone 1st class licenses, no experience necessary. Will learn more than at average station for we are equipped with Diesel Electric power, transmitting and studio equipment."

Telegram from Chief Engineer, Broadcast Station, Wyoming. "Please send latest list available first class operators. Have November 10th opening for two combo men."

Letter from Chief Engineer, Broadcast Station, Texas. "Please send list of latest licensed graduates."

These are just a few of the examples of the job offers that come to our office periodically. Some licensed radioman filled each of these jobs; it might have been you!

HERE IS YOUR GUARANTEE

If you fail to pass your Commercial License exam after completing our course, we guarantee to continue your training without additional cost of any kind, until you successfully obtain your Commercial license, provided you first sit for this examination within 90 days after completing your course.

ACT NOW!

Get All 3 FREE

HERE'S PROOF FCC LICENSES ARE OFTEN SECURED IN A FEW HOURS OF STUDY WITH OUR COACHING AT HOME IN SPARE TIME:

Name and Address	License	Lessons
Lee Worthy, 2210½ Wilshire St., Bakersfield, Cal.	2nd Phone	16
Clifford E. Vogt, Box 1016, Dania, Fla.	1st Phone	20
Francis X. Foerch, 38 Boucier Pl., Bergenfield, N. J.	1st Phone	38
S/Sgt. Ben H. Davis, 317 North Roosevelt, Lebanon, Ill.	1st Phone	28
Albert Schoell, 110 West 11th St., Escondido, Cal.	2nd Phone	23

Your FCC ticket is Recognized in All Radio Fields as Proof of Your Technical Ability.

CLEVELAND INSTITUTE OF RADIO ELECTRONICS
Carl E. Smith, E.E., Consulting Engineer, President
Desk RN-44, 4900 Euclid Bldg., Cleveland 3, Ohio

MAIL COUPON NOW

Cleveland Institute of Radio Electronics
Desk RN-44—4900 Euclid Bldg., Cleveland 3, Ohio
(Address to Desk No. to avoid delay.)

I want to know how I can get my FCC Ticket in a minimum of time. Send me your FREE booklet, "How to Pass FCC License Examinations" (does not cover exams for Amateur License), as well as a sample FCC-type exam and the amazing new booklet, "Money-Making FCC License information."

☐ Tell me about your Television Engineering Course.

Name .....

Address .....

City..... Zone..... State.....

Paste on 2 cent postcard or send air mail.

TV RECEPTION UP TO 200 MILES

ON ACTUAL FIELD TESTS WITH

NEW DX630 CHASSIS

USING THE CASCODE TUNER

will operate in fringe areas or in localities remote from TV broadcast stations up to 200 miles.

HAS 4 MICROVOLT SENSITIVITY—10 times any other TV receiver. Will pick up distant stations without use of booster or special antenna arrays—and with less noise. Will operate any tube including 24", greater brilliance, improved keyed AGC circuit (eliminating flickering and fading). Uses the best materials with a high factor of safety to insure trouble-free operation. STD. RTMA GUARANTEE free replacement of defective parts or tubes for 90 days. Completely factory-wired chassis ready to operate with 12" P.M. Speaker. Price Including Excise tax $144.50

TELEVISION PICTURE TUBES
Standard Brands

ONE-YEAR GUARANTEE

12½" (Black or White)	$22.50	Glass 16" Round (Black)	$24.50
Glass 14" Rectangular (Blk.)	$23.50	Glass 16" Rectangular (Blk.)	$24.50

17" Rectangular (Blk.) $24.50
19" Round (Blk.) $34.50
20" Rectangular (Blk.) $34.50
21" Rectangular (Blk.) $36.50
24" Metal $67.25

Consolette cabinet of beautiful design made of the finest veneers and good finish. Size 39" high x 24" wide x 22¾" deep. Finished in mahogany or walnut. Cut for 630 chassis with 12" speaker; will take either 16, 17, or 20" tube. (Please Specify Size.)

Price including mask and excise tax $43.95
Extra for glass $2.75

For the various other cabinets in our large selection we will furnish photos and other NECESSARY INFORMATION, ON REQUEST.

TELEVISION COMPONENT SPECIALS

"Faster Than Hotcakes!"

That's how these original 13-channel RCA Tuners are selling. Uses 3—6J6 tubes. Sold as is, less tubes, only **$3.95**

NEW STANDARD COIL CASCODE TUNER

The tuner that will give you stronger, better and clearer reception. Uses 1—6J6 and 1—6BK7 Intercarrier $19.95

New—DuMont Tru Focus Conversion Kit

Convert your old set for even focus over entire screen.

DuMont 70° Yoke, Model Y2A1—distributed winding $6.57
DuMont 70° Flyback Transformer Model H1A1 ..... $6.57
DuMont Linearity Control—for above units $0.75
DuMont Width Coil—for above units $0.75

AUTOMOBILE RADIOS

Custom-Built for any of the following 1949-1950-1951-1952 automobiles—Dodge, Plymouth, Chevrolet, Hudson, Studebaker, Henry J. and Ford. Every Radio is a powerfully built, 6 tube superhet with R.F. Stage and 3 gang condenser. Each radio is Custom Built and can be mounted in the dashboard within 4 minutes. Your price including aerial $38.47 ea.

All Merchandise Subject to Prior Sale. All Prices Subject to change without Notice.

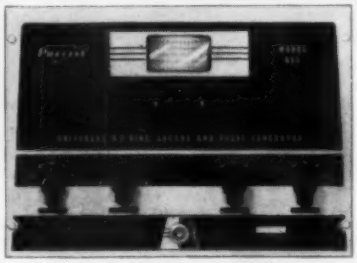
WRITE FOR COMPLETE CATALOG N-5

EDLIE ELECTRONICS INC.

154 Greenwich St. New York 6, New York

cycles; coaxial type fittings; 1% ceramic resistors; an illuminated drum dial; and a completely shielded, wrinkle steel cabinet.

The Model 635 has five ranges covering 20-40 cycles; 40-200 cycles; 200-2000 cycles; 2000-20,000 cycles; and 20,000-200,000 cycles.

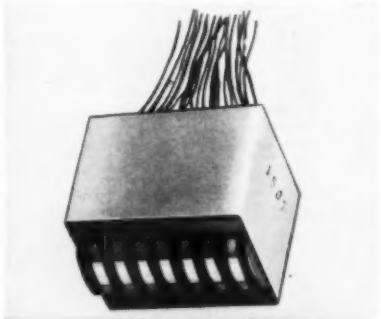


RECORD-REPRODUCE HEAD

The Brush Development Company, 3405 Perkins Avenue, Cleveland 14, Ohio has expanded production on the BK-1500 series multi-channel magnetic record-reproduce heads to include two additional variations which are available at standard prices.

The BK-1500A series are supplied in cartridge form less housing. These units are wrapped in Mumetal foil and are available with from 1 to 14 channels. These heads have a channel width of .050" with center-to-center channel spacing of .125". Gap width is .0005". Four free lead wires per channel are provided.

The BK-1500N series may be supplied in cartridge form or in housing. The channel width has been reduced to .044" to provide a wider land between tracks so that two multi-channel units may be mounted in staggered fashion with interlacing channels.



Design features include precise gap alignment, balanced magnetic construction, and Mumetal shields between channels. The entire assembly is cast into one integral block of specially selected synthetic resin which makes the units moistureproof and non-microphonic.

5-INCH SCOPE

Hickok Electrical Instrument Company, 10677 Dupont Avenue, Cleveland 8, Ohio has recently released data on its new Model 670 5-inch scope which has been designed to permit the visual testing and alignment of AM-FM and TV receivers when used with a frequency-modulated r.f. oscillator or sweep generator.

This model has a sensitivity of 10 mv. r.m.s. per inch to permit the proper viewing of TV response curves. The instrument covers from d.c. to 500 kc. and is usable to beyond 2 mc.

Provision is made for the direct connection to both horizontal and vertical plates of the cathode-ray tube. In addition, line phasing control, negative and positive synchronizing, reversing switches for both horizontal and vertical deflection, and provision for "Z" axis modulation, are included.

Complete information on the Model 670 is available on request.

PRESSURE GAUGE

Garrard Sales Corp., 164 Duane Street, New York, N. Y. has introduced a new accessory unit which is designed to measure the stylus pressure of phonograph pickups.

The new stylus pressure gauge

checks the weight exerted by any tone arm or pickup on the record grooves. The unit is scientifically calibrated with large, easy-to-read markings at one gram intervals. All moving parts are of lightweight alloy and completely sealed so that no damage can be done to the delicate spring mechanism. Performance characteristics will not alter due to weather conditions or continued use. The gauge is housed in a red and ivory plastic case.

POWER UNITS

Opad-Green Company, 71-3 Warren St., New York 7, N. Y., has announced a new series of industrial power units that supply 115 or 230 volts d.c. from existing a.c. power lines.

Starting at 125 w. capacity, the series includes 42 standard models. Units are available for use with 115, 230, or 440 volts, 60 cycle a.c. All of the units are housed in ventilated cabinets.

NEW INSULATION

Gustin-Bacon Manufacturing Co., 1412 W. 12th Street, Kansas City, Missouri, has recently introduced an improved double-duty glass fiber insulation which has been tradenamed "Ultralite."

The new insulating product is made of long, fine textile-type glass fibers, bonded together with a thermal-setting plastic resin to form a resilient, semi-rigid insulation material. It is available in varying densities. It is ex-

(*Continued on page* 101)

Rauland Tubes give you a prettier profit picture

Rauland picture tubes are first choice of an ever growing number of service dealers and men. First, because of the completeness of the Rauland replacement line.

Second, because you get the benefit of acknowledged leadership in picture tube engineering. Rauland research has developed more picture tube improvements since the war than any other company.

You get quality you can count on, too. Rauland production employs machines unique in the industry —many of them designed by Rauland engineers and built in Rauland's own plant.

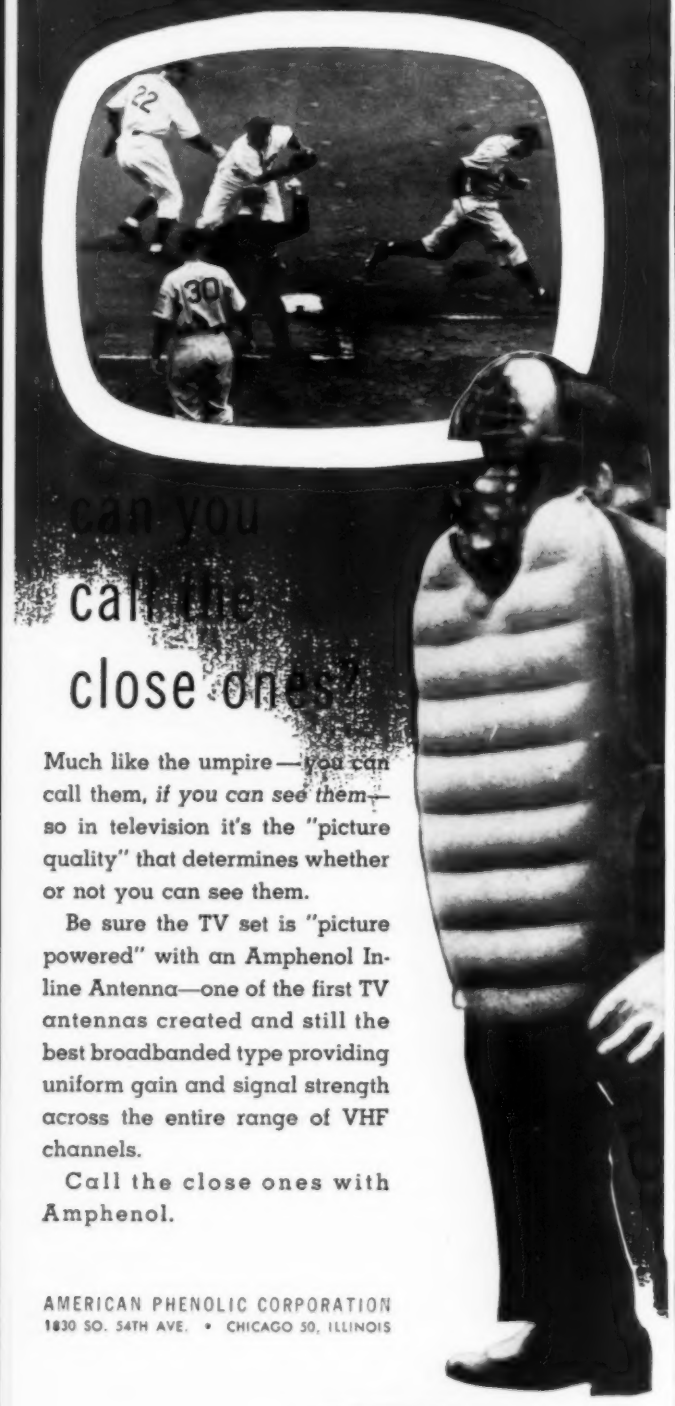
And finally, you get assurance of customer satisfaction beyond what any other line can give you. Installation and adjustment of Rauland tubes is faster and better. The Indicator Ion Trap gives you the surest known protection against ion burn and shortened tube life.

Specify Rauland—deliver Rauland—and assure yourself of pleased picture tube customers.

THE RAULAND CORPORATION

Perfection Through Research

4245 N. KNOX AVENUE • CHICAGO 41, ILLINOIS



Much like the umpire—you can call them, *if you can see them*—so in television it's the "picture quality" that determines whether or not you can see them.

Be sure the TV set is "picture powered" with an Amphenol In-line Antenna—one of the first TV antennas created and still the best broadbanded type providing uniform gain and signal strength across the entire range of VHF channels.

Call the close ones with Amphenol.

AMERICAN PHENOLIC CORPORATION
1830 SO. 54TH AVE. • CHICAGO 50, ILLINOIS

AMPHENOL

Dealers, Installers, and Owners of TV sets will all be interested in this free book. Write Department 13A.

WCEMA-IRE WEST COAST MEET

By
RALPH L. POWER, Ph.D.

Western Electronic Show to be held August 27, 28, and 29 in Long Beach.

ONE of the highlights of the year, as far as the West Coast electronics industry is concerned, will be the Western Electronic Show and Convention held this year at Long Beach, California, August 27, 28, and 29.

Co-sponsored by the West Coast Electronic Manufacturers' Association and the Seventh Region of the Institute of Radio Engineers, this year's event will include a comprehensive display of electronic equipment which will be on view in the more than 200 booths that will occupy two floors of the Long Beach Municipal Auditorium.

The Show Committee, which is made up of representatives from both the IRE and WCEMA, is headed by R. G. Leitner with Hecker Parker serving as business manager. Howard Grove is vice-chairman for the IRE on the committee while Leon B. Ungar, president of WCEMA, is vice-chairman representing that group.

The technical papers committee, headed by Frederick Suffield, has planned a well-rounded program which will feature well-known speakers discussing topics of interest to IRE members and other technically-minded conventioneers.

The committee has planned several papers and sessions under each of twelve professional sections: airborne electronics; antennas and propagation; audio; broadcast transmission systems; circuit theory; electron devices; electronic computers; information theory; instrumentation; data handling; radio telemetry; and remote control. In addition they have planned some evening sessions on engineering management and engineering patents for those interested in these specialized topics. The lecture hours have been staggered to permit those attending the convention to cover as many of the meetings as possible.

The annual IRE luncheon will be one of the highlights of the action-packed three-day schedule. The Seventh Region's annual achievement award winners will be announced at the luncheon. A prominent speaker will address the gathering.

The all-industry cocktail party, which is open to all segments, is expected to be a sell-out.

The Los Angeles and San Francisco chapters of "The Representatives" which have always assisted with the liaison work, manning the information booths, etc., will again help smooth the way for convention delegates.

WCEMA'S BACKGROUND

The West Coast Electronic Manufacturers' Association was organized in 1943 to assist West Coast factories in obtaining government contracts for electronic equipment.

While individual manufacturers tried the direct approach to obtain such contracts, it was not until WCEMA spokesmen went after the orders did the West Coast receive its fair share of the electronics business.

By pooling industry resources, government officials could get an over-all picture of existing facilities in the west, the potentiality of the field, the availability of skilled craftsmen, designing and engineering facilities, and the type of "know-how" which could be utilized.

Once a year WCEMA publishes a directory in which are listed information about the member-companies, an index of products manufactured, and a compilation of the Association officers, and other pertinent data.

Publication office for the Directory is at 767 Castelar Street in Los Angeles. The secretary of the San Francisco Council (J. J. Halloran) can be reached at 6021 College Avenue, Oakland 18, California. George B. Clark, the Los Angeles Council secretary, is located at 4054 Ocean Park Avenue, Venice, California. —30—

BUY TEST EQUIPMENT
ON THIS RADICALLY NEW
TIME PAYMENT PLAN
NO INTEREST!! - NO CARRYING CHARGES!!
USE CONVENIENT TIME PAYMENT ORDER BLANK BELOW

Superior's New
JUNIOR SUPER-METER
MOST COMPLETE AND COMPACT MULTI-SERVICE INSTRUMENT EVER DESIGNED

Measures: * Voltage * Capacity * Current * Reactance * Decibels * Resistance * Inductance

Specifications: D.C. Volts: 0-7.5/75/150/750/1500 Volts. A.C. Volts: 0.15/150/300/1500/3000 Volts. Resistance: 0-10,000/100,000 ohms. 0-10 Megohms. D.C. Current: 0-7.5/75 Ma. 0-7.5 amps. Capacity: .001 Mfd.—.2 Mfd. .1 Mfd.—20 Mfd. Electrolytic Leakage: Reads quality of electrolytics at 150 Volt test potential. Decibels: —10 Db to +18 Db. + 10 Db. to + 38 Db. + 38 Db. to + 58 Db. Reactance: 15 ohms—25 K ohms 15 K ohms—2.5 Megohms. Inductance: .5 Henry—50 Henries 30 Henries—10 K Henries. Plus Good-Bad scale for checking the quality of electrolytic condensers.

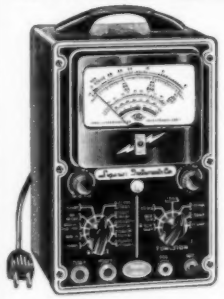
Handsome round cornered molded bakelite case 3⅞" x 5⅝" x 2¼" complete with all test leads and instructions ..... **$21.40 NET**

Superior's New Model TV-11
TUBE TESTER

• Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary. • Uses no combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket. • Free-moving built-in roll chart provides complete data for all tubes. • Phono jack on front panel for plugging in either phones or external amplifier detects microphonic tubes or noise due to faulty elements and loose external connections.

Operates on 105-130 Volt 60 Cycles A.C. Hand-rubbed oak cabinet complete with portable cover ..... **$47.50 NET**

Superior's New Model 670-A
SUPER-METER



A COMBINATION VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts.
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts.
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes.
RESISTANCE: 0 to 1,000/100,000 Ohms 0 to 10 Megohms
CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd. (Quality test for electrolytics)
REACTANCE: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms
INDUCTANCE: .15 to 7 Henries 7 to 7,000 Henries
DECIBELS: —6 to +18 +14 +38 +34 to +58

ADDED FEATURE:
The Model 670-A includes a special GOOD-BAD scale for checking the quality of electrolytic condensers at a test potential of 150 Volts.

The Model 670-A comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 6¼"x9½" x4½". **$28.40 NET**

Superior's New
TV BAR GENERATOR

Throws an Actual Bar Pattern on Any TV Receiver Screen!!

Two Simple Steps:

1. Connect Bar Generator to Antenna Post of any TV Receiver.
2. Plug Line Cord into A.C. Outlet and Throw Switch.

RESULT: A stable never-shifting vertical or horizontal pattern projected on the screen of the TV receiver under test.

Power Supply: 105-125 Volt 60 Cycles. Power Consumption: 20 Watts. Channels: 2-3 on panel, 7-13 by harmonics. Horizontal lines: 4 to 12 (Variable). Vertical lines: 12 (Fixed). Vertical sweep output: 60 cycles. Horizontal sweep output: 15,750 Cycles.

TV Bar Generator comes complete with shielded leads and detailed operating instructions. Only NET **$39.95**

New Model 200 AM and FM
SIGNAL GENERATOR
Provides complete coverage for A.M.-F.M. and TV alignment

• R.F. Frequency Ranges: 100 Kilocycles to 150 Megacycles. • Modulating Frequency: 400 Cycles. May be used for modulating the R.F. signal. Also available separately. • Attenuation: The constant impedance attenuator is isolated from the oscillating circuit by the buffer tube. Output impedance of this model is only 100 ohms. This low impedance reduces losses in the output cable. • Oscillatory circuit: Hartley oscillator with cathode follower buffer tube. Frequency stability is assured by modulating the buffer tube. • Accuracy: Use of high-Q permeability tuned coils adjusted against 1/10th of 1% standards assures an accuracy of 1% on all ranges from 100 Kilocycles to 10 Megacycles and an accuracy of 2% on the higher frequencies.

* Tubes used: One 954 as oscillator; one 954 as modulated buffer amplifier; T-2 as modulator; 7193 as rectifier.

The Model 200 comes complete with output cable and operating instructions ..... **$21.85 NET**

NEW TIME PAYMENT PLAN
ORDER BLANK

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. B-29, 38 Murray Street, New York 7, N. Y.

Please send me the units checked below. I am enclosing the down payment with order and agree to pay the monthly balance as shown. It is understood there will be no carrying, interest or any other charges, provided I send my monthly payments when due. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

☐ **JUNIOR SUPER METER**.....Total Price $21.40
$5.40 down payment. Balance $4.00 monthly for 4 months.

☐ **MODEL TV-11**.....Total Price $47.50
$11.50 down payment. Balance $6.00 monthly for 6 months.

☐ **MODEL 670-A**.....Total Price $28.40
$7.40 down payment. Balance $3.50 monthly for 6 months.

☐ **TELEVISION BAR GENERATOR**.....Total Price $39.95
$9.95 down payment. Balance $5.00 monthly for 6 months.

☐ **MODEL 200**.....Total Price $21.85
$5.85 down payment. Balance $4.00 monthly for 4 months.

☐ I enclose $..... as down payment.

☐ Ship C.O.D. for the down payment.

Signature.....

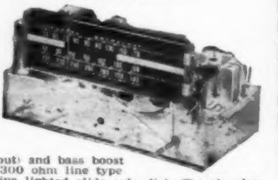
Name .....

Address .....

City..... Zone..... State.....

IT'S A BIG PUBLIC ADDRESS SYSTEM YEAR—LOOK AT McGEE'S VALUES

ESPEY 12-TUBE FM-AM CHASSIS, $64.50



★ BUILT-IN PRE-AMP FOR G.E. VARIABLE RELUCTANCE PICK-UP
★ WIDE RANGE AUDIO
★ WHY NOT ORDER WITH A COAXIAL SPEAKER AND A RECORD CHANGER? SEE OUR SPECIAL OFFERING

McGee's new 1952 model 12-tube FM-AM chassis. Latest design with phono inputs for all types of record players, crystal or G.E. variable reluctance. Receives standard broadcast 550 to 1700 kc and FM 88 to 108 mc. Wide range audio response (push-pull 6V6 output) and bass boost tone control. Loop antenna for broadcast and 300 ohm line type FM antenna may be stapled in cabinet. Attractive lighted slide rule dial. Chassis size, 13½" x 9" high and 9" deep. Complete with tubes: 6BE6, 6BA6, 6BA6, 12AT7, 6SH7, 6AL5, 6SQ7, 6SQ7, 12AT7, 2—6V6GT and 5Y3GT rectifier. Shipping weight 20 lbs. Stock No. 7C-X Espey 12-tube FM-AM chassis. Sale price, **$64.50**, less speaker. Output matches voice coil of our 12" or 15" coaxial speakers.

ESPEY DEAL (1), $104.95

Espey 7-C chassis complete with 12" coaxial PM speaker CU-14Y and VM-950 G.E. 3-speed changer equipped with a G.E. turnabout variable reluctance cartridge. A better home music system than ordinarily available. Espey Deal #1. Sale price **$104.95**. With 15" coaxial PM speaker P15-CR instead of CU-14Y. **$10.00** extra.

ESPEY DEAL (2), $118.95

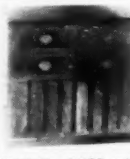
Espey 7-C chassis complete with 12" coaxial PM speaker CU-14Y and the English Garrard 3-speed changer equipped with a G.E. variable reluctance turnabout cartridge. Our best home music system, Espey Deal #2. Sale price **$118.95**. With 15" coaxial PM speaker P15-CR instead of CU-14Y. **$10.00** extra.

ESPEY DEAL (3) $138.95

Espey 7-C chassis complete with THREE 12" coaxial PM speakers CU-14Y (these three 12" coaxial speakers give a cone area equal to an 18" speaker) and a Garrard 3-speed changer with G.E. variable reluctance turnabout cartridge, Espey Deal #3. Sale price **$138.95**.

CAPEHART CABINET, $79.95

BLANK OR CUT TO FIT ESPEY CHASSIS



Buy this cabinet with Espey chassis and the VM changer listed above and have a fine radio-phono combination for less than the value of the cabinet alone. This beautiful cabinet was intended for a Capehart $800.00 combination. It is the finest possible furniture quality cabinet workmanship, 37" high, 40" wide and 21" front to back. Hinged top lifts in two sections, 25½" lid covers the changer compartment and 14½" is the width of the radio compartment. Changer mounting panel is furnished blank. Radio panel is shipped ready cut to fit the 7-C Espey chassis. Baffle is cut to hold 2—12" speakers. Made of top quality walnut veneer, ⅞" material used throughout. Shipped via truck, rail or express only. Shipping wt., 160 lbs. Stock No. C-175, with panel cut to fit Espey 7-C. **$79.95**. Stock No. B-175B, with blank changer and radio panel. **$79.95**. Buy 2—12" 32 oz. Alnico PM speakers for use in this cabinet for only **$15.00 ($7.50 each)**.

McGEE'S $62.50 LIST 15" COAXIAL SPEAKER, $24.95

21 OZ. ALNICO V MAGNET—5" TWEETER

This is the finest 15" coaxial PM speaker value that we have ever offered. New 1952 production, of a famous manufacturer of fine speakers. The 15" speaker has a 21½ oz. Alnico V magnet; equal to 68 oz. of the Alnico 3 type magnet. The cone is free floating, of one piece construction. Will reproduce low frequencies down to 20 cps. The 5" tweeter is coaxially suspended and has a ridged cone to reproduce only the high frequencies. It will respond up to 17,500 cps. The high-pass filter is concealed under the pot cover, leaving only two wires to connect both the tweeter and woofer to any 8 ohm output transformer of a radio, or high fidelity music lover's amplifier. Stock No. P15-CR, shipping weight 13 lbs. Net price **$24.95**; 2 for **$47.95**.

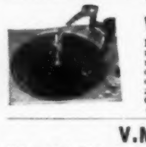
12" COAXIAL SPEAKER, $12.95

McGee offers the new 1952 model 12" coaxial PM speaker. Quality you would put in your finest sets if you were a manufacturer. 12" woofer has 6.8 oz. Alnico V magnet. Tweeter is coaxially suspended and has a metal diffuser. High pass filter is under the pot cover. Only two wires to connect to your radio or audio amplifier. 8 ohm with 18 watt peak and 10 watt average. Shipping weight 8 lbs. Response from 30 to 17,500 cps. Stock No. CU-14Y. Sale price **$12.95** each; 2 for **$25.00**.

12" JENSEN PM, $15.95

Another McGee Scoop! Jensen Concert 12", 14½ oz. Alnico V magnet PM speaker. 8 ohm voice coil. Will take 25 watt audio. You save dollars on this speaker. Just 100 to sell. Shipping weight 8 lbs. Stock No. P-12P. Sale price **$15.95**; 2 for **$30.00**.

3-SPEED CHANGERS ON SALE AT McGEE



WEBSTER CHICAGO MODEL 100-2 ONLY $26.95

For the first time we offer the world famous Webster-Chicago, model 100-2. Features a newly designed spindle, that drops the records flat: air-cushioned to the turntable. Pickup arm sets down automatically after the last record plays. Plays all records automatically, 33⅓, 78 and 45 rpm. New balanced tone arm with Electro-Voice Tilt-A-Matic cartridge with dual needles. Ordinarily cost over **$37.00**. McGee offers them for only **$26.95** each. Base size 12"x12¾". Shipping weight 14 lbs.

V.M. 3-SPEED MODEL 406 $22.95

VM model 406, deluxe 3 speed automatic record changer. Plays them all. Intermixes records of the same speed. Equipped with a flip over crystal pickup with twin needles. Base size, 12¼x13". Shipping weight 12 lbs. VM-406. Net price **$22.95**.

G.I. 3-SPEED CHANGER WITH G.E. $22.95

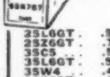
VARIABLE RELUCTANCE TURN-ABOUT CARTRIDGE

Another tremendous McGee Scoop! Brand new General Instrument 3-speed automatic record changers. Complete with RPX-050 G.E. variable reluctance cartridge with turn-about stylus. Plays all 3 speeds automatically: 7", 10" or 12" records. Has reject button. Repeats last record. Base size, 12"x12⅞". Shipping weight 14 lbs. Stock No. 700-GE. Scoop price. **$22.95**.

ELECTRONIC RADIO and TV TUBES

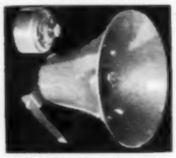
• 6 MONTHS' GUARANTEE • INDIVIDUALLY CARTONED
• IN RED AND BLUE DE LUXE VARNISHED CARTONS
• EVERY TUBE SET TESTED FOR YOUR PROTECTION

ORDER 50 ASSORTED—TAKE 10% OFF. Prices as Low as 36c



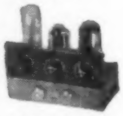
0Z4	$ .59	6AL5	.49	6S8GT	.89	7Z4	.69		
1B3	.89	6AQ5	.59	6SA7GT	.59	12AT6	.49		
1C6	.79	6AT6	.49	6SD7GT	.69	12AT7	.69	25L6GT	.59
1G4	.69	6AU6	.59	6SE7GT	.59	12AU7	.69	25Z6GT	.79
1H5	.59	6AV6	.49	6SF7	.69	12AV7	.89	35C5	.59
1J6	.99	6B8G	.69	6SG7	.69	12AX4GT	.69	35L6GT	.59
1L4	.59	6BA6	.59	6SH7GT	.69	12AX7	.69	35W4	.49
1LA4	.79	6BA7	.69	6SK7GT	.59	12BA6	.59	35Z5GT	.49
1LC5	.79	6BC5	.59	6SL7GT	.69	12BA7	.69	35/51	.69
1LE3	.79	6BE6	.59	6SN7GT	.69	12BE6	.59	38	.59
1LG5	.79	6BG6G	1.29	6SU7GT	.69	12BF6	.79	39	.49
1LN5	.79	6BH6	.59	6U7G	.69	12J5GT	.69	41	.79
1R5	.59	6BJ6	.59	6U8	.79	12J7GT	.69	47	.89
1S5	.59	6BK7	.99	6V6GT	.59	12K7GT	.69	50B5	.59
1T4	.59	6BQ6GT	.99	6W4GT	.59	12Q7GT	.59	50C5	.59
1U4	.59	6C4	.49	6X4	.49	12SA7GT	.59	50L6GT	.59
1U5	.59	6C6	.59	6X5GT	.49	12SF5GT	.69	56	.49
2X2	.89	6CB6	.59	6T7G	.99	12SJ7GT	.59	57	.49
3A4	.69	6CD6G	1.49	6ZY5G	.59	12SK7	.59	58	.49
3Q4	.69	6H6GT	.59	7B6	.69	12SQ7GT	.59	76	.49
3V4	.69	6J5GT	.49	7E5	.69	12SR7	.69	77	.69
5T4	1.49	6K6GT	.49	7E6	.89	14A4	.89	78	.69
5U4	.49	6K7GT	.59	7E7	.89	14B6	.99	85	.79
5X4	.69	6K7G	.59	7H7	.79	14C5	1.09	89	.79
5Y3	.40	6L6G	1.09	7N7	.59	14H7	.79	117L7GT	1.49
6AB4	.69	6L7G	1.09	7V7	.99	14Q7	.99	117Z3	.49
6AJ5	.69	6P5GT	.59	7X7	.99	19T8	.89	955	.79
6AK5	.99	6S4	.59	7Y4	.79	25BQ6GT	.99		

50-WATT BOOSTER AMPLIFIER—$39.95



25-Watt Horn $28.95

50-Watt Booster $39.95



2-Mike Pre-Amp. $12.95 Extra.

50-WATT BOOSTER A sensational value. 50 watt booster amplifier with push-pull parallel 6L6 output tubes. Connect to your present amplifier as a booster or use with the PR-2X Pre-amp to add the use of 2 mikes and one low level input. The booster amplifier has one input jack and with 1 volt input gives 50 watts of audio. Booster has a 6 lb. potted case high fidelity output transformer, matches speaker with 4-8-16 ohm voice coil, also 60 ohm and 250 ohm line. Booster has a 225 mill power supply with 5U4 rectifier. Price includes tubes: 4 6L6, 7N7 and 5U4. The two variable controls are for master volume control and base boost tone control. Size 8 x 6½ x 14½. Stock No. PA-55N. Shipping weight 26 lbs. Sale price **$39.95** ea.

2-MIKE PRE-AMP. Pre-amplifier plugs in directly to the PA-55N Booster amplifier. It enables use of 2. Crystal or Dynamic Mikes plus one low level input. Furnished with 4 foot cables and plugs for remote control of the 55 watt Booster Amplifier. Small chassis size 5 x 3¼ x 4". Stock No. PR-2X, with tubes 7F7 and 7N7. Net price **$12.95** ea.

25-WATT HORN 25-Watt Driver and 3½-foot air column re-entrant Trumpet. The standard type trumpet and driver you see the most. Drivers are 100% weatherproof, horn is spun aluminum, offered to you at a considerable savings. Stock No. MA-33. Shipping weight 20 lbs. Net price **$28.95**.

25-WATT 6-110 VOLT MOBILE AMPLIFIER, $115.95

REGULAR $190.00 LIST—1952 MODEL
25-WATT TRUMPETS AND DRIVER
$28.95 EACH EXTRA

25 watt Mobile Amplifier has built-in phono unit, illuminated control panel, separate volume controls for microphone, and phono and tone control. Power output 25 watts at less than 5% distortion. Peak power 38 watts. Frequency response: Plus or minus 2 db. 30 to 15,000 cps. Overall gain: Microphone channel 115 db.; phono channel 82 db. Hum level: 60 db. below rated output. One microphone and one phono input. Input impedance: 10 meg. microphone channel, ½ meg. phono channel. Controls: Microphone volume, phono volume, tone with AC switch, standby switch and phono motor off-on switch. Output impedance: 2.5, 4, 8, 16, 250, 500 ohms and 70 volt constant voltage tap. Operates on 117 volts 60 cycles AC or 6 volts DC. Draws 24 amps on DC operation. Tubes: 7B4, 6C5, 6SN7GT, 2—6L6G, 2—6X5GT. Overall size, 11½" deep, 10" high and 16½" wide. Shipping weight, 40 lbs. Stock No. 2370. 25 watt 6-110 volt amplifier. Net price, **$115.95**.
Use either 2, 3, or 4 of our MA-33, 25 watt trumpet and driver combinations, pictured at top of this page. Net price, **$28.95** each; or any combination of PM speakers and baffles shown below. Astatic JT-30 crystal mike and desk stand, **$9.95** extra.

TERRIFIC VALUES IN SPEAKERS AND BAFFLES

8" PM AND LEATHERETTE BAFFLE, $4.95
LOTS OF 10, $4.75

The finest Leatherette Baffle we have ever offered. New self-supporting plastic grill material, baffle is covered tan with matching grill. Offered with a good heavy duty 8" Alnico V PM speaker with 3.2 ohm voice coil, Stock No. 818. Speaker and Baffle, **$4.95** ea.; lots of 10, **$4.75**. 8". Baffle only. Stock No. NV-8, **$2.29** ea.; 10 for **$19.95**.

12" PM AND WALNUT BAFFLE, $9.95
LOTS OF 3, $8.95

The finest built 12" Walnut plywood wall baffle we know of. Factory cost of the famous juke box manufacturer exceeds $7.00, we offer with a 12" PM for little more. You pay only **$9.95** in single lots, or **$8.95** in 3 lots for both a 12" Quam Alnico V PM with 3.2 ohm voice coil and the beautiful wall baffle, 12" Speaker Baffle combination, Stock No. BS-12Q. **$9.95** ea.; lots of 3, **$8.95** ea. 12" Baffle only, #SEG-12, **$4.95** each.

MIKES AND STANDS

4D-T, high impedance dynamic mike with 12 feet of cable. Sale price, **$10.95**. 35" to 64" chrome floor stand for mike, **$5.88**.

McGee's Super High Fidelity *Best Value in U. S. A.*

OUTPUT TRANS. 20-20,000 CPS. **$7.95**

Model A-403 High fidelity output transformer. Why pay $20 or $30 for an output, when our A-403 is available at $7.95? Impedance, 6600 ohms plate to plate (for PP 6L6 or 6V6), 10% feedback winding, 4-8-15-250 and 500 ohm secondary. Housed in a potted case. Net weight 6 lbs. Recommended for all amplifiers up to 34 watts.

3-STATION INTERCOM MASTER, $14.95
USE UP TO 3-SUB STATIONS, $4.49 EACH

A red-hot intercom master value. A full 3 tube, 110 volt AC-DC master, with 3 station selector switch and easy accessible volume control. Small compact size. 5"x 6"x6½" high. Makes an attractive intercom installation. May be used with from one to three of our G-4T substations described below. Intercom master is quiet at all times, except when press-to-talk switch is pressed at either the master, or one of the subs. Shipping wt. 5 lbs. Stock No. KA-3, master station, less subs. Net **$14.95**. Stock No. G-4T, brown plastic substation, with Alnico V PM speaker and press-to-talk switch. May be purchased with or without master station. Shipping weight 2 lbs. Net. **$4.49** ea.
3 wire plastic intercom cable, 100 ft. **$1.95**; 500 ft. **$8.95**.

TERRIFIC FLUORESCENT FIXTURE SALE

IS YOUR SERVICE DEPT. PROPERLY LIGHTED? SAVE 50% ON THIS 4-LIGHT FIXTURE
$12.95, TWO FOR $25.00 WITH LAMPS

TOP ILLUSTRATION—This is the finest value in a fluorescent fixture that we have ever offered. Constructed of heavy gauge metal with lustre white enamel finish. All General Electric high power factor ballasts. Furnished with General Electric 36", 30 watt white fluorescent lamps. Fixture may be mounted next to the ceiling or suspended on chains. These fixtures are beautifully constructed. Use them over your service bench, in your display room or in your office. Brand new in factory cartons properly packed for shipment. These fixtures sold for up to $30.00. We bought 6 truck loads and are passing our bargain on to you. Why pay more than this to modernize your shop. Shipping weight 26 lbs. each. Shipped via Express, Rail Freight or Truck only. Stock No. MK-430 fixture complete. Net **$12.95**; 2 for **$25.00**.

DELUXE MODEL WITH GLASS, $14.95; CEILING CANOPY, $1.95

Bottom Illustration

Deluxe Model No. MK-430X, same as No. MK-430 described above with the exception that it has translucent glass over the lamps to diffuse the light. CEILING CANOPY that is shown, **$1.95 extra**. Shipping weight 33 lbs. Net price **$14.95**; 2 for **$28.00**.

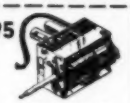
Canopy for suspending either of the above fluorescent fixtures 30" from the ceiling. For use where it isn't advisable to mount fixture flush or suspend it on chains. Canopy kit is complete with stamped metal box cover with hardware for mounting to any outlet box and 2—30" lengths of ⅜" white enameled tubing. Ship. wt. 6 lbs. Fixture canopy kit. No. 1-30. **$1.95**.

McGEE RADIO COMPANY Prices F.O.B. K.C. Send 25% Deposit with Order, Balance Sent C.O.D. With Parcel Post Orders, Include Postage

TELEPHONE VICTOR 9045. WRITE FOR FLYER
1422 GRAND AVE., KANSAS CITY, MISSOURI

TELEVISION FRONT ENDS on SALE at McGEE—STANDARD COIL, RCA, SARKES-TARZIAN

STANDARD COIL CASCODE TUNER $19.95



The Cascode Circuit of the Standard Tuner offers a new development of this famous TV front end assembly which affords a 2-to-1 improvement in gain and a 35% to 50% reduction of noise over the pentode tuner. Other advances include: UHF reception by interchange of channel inductors; increased sensitivity for TV sets in fringe areas; elimination of booster use; and a high profit item for the serviceman as a replacement unit sale. Brand new factory cartoned. Series TV-2000 TV tuner, compl. with tubes 6BK7 or 6BQ7 and a 6J6. Second price, **$19.95** ea.

THE ORIGINAL STANDARD COIL TV TUNER $12.95 ANOTHER McGEE SCOOP

Five millions of this 12-channel Standard Coil tuner now in use. The popular model with clip-in channel inductors and concentric fine tuning shaft. You save over 50%. Price includes tubes. Stock No. SC-947, **$12.95** each: 2 for **$25.00.** Choice of 2⅞" or 3¼" length insulated shaft. Used on Emerson Model 650D, 655, etc. Filaments connected in series (12 volts) and shunted .6 amp drain for AC-DC TV sets. Priced with tubes 6AG5 or 6BC5 and 6J6. Stock No. SC-948, each; 2 for **$27.00.** Available with either 3", 3½", or 5" shaft length. Filaments are in parallel for 6.3 volts AC operation. Price includes tubes 6AG5 or 6BC5 and 6J6. Note: Both tuners have IF coil attached for intercarrier sets. For sets with separate sound we suggest using the convertor coil on the following stage. (Diagram furnished with each tuner.) Bakelite channel selector knob with embossed channel markings. **59c** extra.

GENERAL INST. T.V. TUNER $7.95

This popular General Instrument TV tuner has been used on thousands of late model TV sets. It has built-in fine tuning and 12 channel selector control. This tuner differs from other tuners in that it is built around a tuning component and a unique switching arrangement. A convertor coil is not mounted on this tuner. Priced complete with 3—6J6 tubes. Shipping wt., 3 lbs. Stock No. GI-WT3, with tubes. Net price, **$7.95.** Specify shaft length desired, either 1¾" or 7".

$2.95 SPECIAL. GI-312, same as above GI Tuner only less tubes and in repairable condition. 1¾" and 7" shafts available.

3-TUBE SARKES-TARZIAN T.V. TUNER $9.95

This popular Sarkes-Tarzian Type 3 tuner is widely used. 13 channel rotary type switch with individually tuned coils. Price is complete with diagram and three tubes: 6C4 osc., 6BH6 R.F. and 6AG5 mixer. Regular factory cost is twice our price. Each tuner is wired ready to hook up to a video and sound IF strip. May be used with either inter-carrier or separate sound IF circuits. Has built-on convertor coil, built in fine frequency control. Sarkes-Tarzian TV tuner, with 3 tubes. Net price, **$9.95** each. Specify shaft length, either 2½" or 4¾".

RCA 201E1 T.V. TUNER $7.95

Terrific buy on this RCA tuner. We have a limited quantity of the famous original 201E1, 13 channel completely wired and tested TV front end tuners. Ready to connect to your TV video I.F. strip. Offered at a sacrifice. Price was $44.00. Now only **$7.95** each, with tubes. Each tuner in good condition but has been repaired. Stock No. RCA-13P, TV front end tuner. Convertor coil type for separate sound as used in the famous 630 chassis. Complete with 3—6J6 tubes, **$7.95.** Specify shaft length desired, either 2" or 4".

WIRED VIDEO I.F. STRIP $3.95

This wired video I.F. strip is a perfect replacement for several model Crosley TV sets, such as Model No. 51-442MU, 51-446MU and many others. Offered at less than the factory production cost. 5 tubes are required. 2 6AU6, 1st and 2nd video, 6AL5 video detector and either 2 6AG5 or 3 6BC5 3rd and 4th video, 1st I.F. 22.9 mc, 2nd 26.55 mc, 3rd, 22.2 mc, 4th 23.4 mc. This strip has dozens of resistors, ceramic capacitors and slug tuned I.F. coils. Ideal for set builders, or "hot" replacement strip for TV servicing. Stock No. CR-51F, **$3.95** each. Kit of 5 tubes for this I.F. strip, **$3.50** extra.

SARKES-TARZIAN—SPEC. $2.95

I.F. Coil. Requires 2 6AG5 or 2 6BC5 and a 12AT7. Has ¼ diameter shaft, 2⅜" long. Screwdriver slot fine tuning adjustment. It differs from other tuners in that it has no concentric fine tuning shaft over the channel selector shaft. Very fine for experimenters, builders, boosters, signal strength meters, etc. Sarkes-Tarzian Type 4 TV tuner less tubes, **$2.95.** Set of 3 tubes for this tuner, **$1.80** extra.

SNOW FILTER FOR FRINGE AREA

Reduces glare, increases contrast. Easily installed with double faced adhesive supplied with filter. Available in Blue or Smoke color, in sizes for 16" to 20" screen.

No. 126. 12" x 16" for 16 and 17" tubes, Blue or Smoke, **$1.95** ea.

No. 129. 15" x 20" for 20" TV screen, Blue or Smoke, **$2.65** ea.

14 KV FLYBACK ONLY $2.95

Genuine General Electric flyback made for Arvin. Conventional type for 70° deflection yokes and all 14", 16", 17", 20" and 21" rect. tubes. Delivers up to 14,000 volts. Has fiber punched for 1x2 rectifier socket. Used with 6BQ6, 6BG6 or 6CD6 horizontal output and 1B3 or 1x2 rectifier. Schematic with each terminal identified is furnished. No. T-77J3, **$2.95** each. **$2.50** each in lots of 3 or more. 70° Deflection Yoke **$2.95** extra.

MEISSNER TV TUNER WITH 3-6J6 $5.95

Meissner 12-channel television tuner. Ready wired and with 3-6J6 tubes. A 12-channel rotary switch type with separate coils for each channel. Built-in fine frequency control. Ideal for builders, experimenters. Stock No. 13-7624, Sale price, **$5.95** each, with tubes.

GENUINE STANDARD COIL T.V. BOOSTER $11.95

Not Surplus, But Right From the Factory

Latest Model B-51 Standard Coil Television Booster. McGee makes another lucky purchase and as usual, passes the saving on to you. The famous Model B-51, 12 Channel Standard Coil TV booster, which lists for $35.00, is offered to you for only **$11.95** each. Brand new, factory cartoned and fully guaranteed by McGee. This top quality single stage booster utilizes printed high frequency circuits, for improved performance on all channels. Uses 6AK5 tube. Average gain, 6 to 7 volts on low channels and 5 or 6 on high channels. No distorting of picture or sound. Has extremely low noise factor. Continuous one-knob tuning and channel selector control switch for off-on and by-passing 300 ohm lead-in to set. Modern design, dark brown plastic cabinet, 8"x4¼"x4½". Made for 110 volt, 60 cycle AC operation. Shipping weight 5 lbs. Model B-51. Sale price, **$11.95** each, or buy 2 for only **$22.00.**

McMURDO SILVER BOOSTER $10.95

Sensational value. Continuously variable inductance type tuner, from channel 2, including the FM band, through channel 13. This booster is self powered for 110 volts AC operation. Incorporates 6J6 and 6AC7. Input and output for both 72 and 300 ohm. Mahogany finished metal cabinet 6¼x4¼x4¾" high. Model CT-1. Net price **$10.10.**

ALLIANCE TENNA ROTORS $26.43

Two trouble free models to choose from. Model HR automatically aims antenna at the station you select, just set pointer to the position desired. Model DR starts, stops and reverses instantly. Meter shows antenna position at all times. Both have fully encased motors. Operates on 110 volts. Net price for either **$26.43.** Use 4 wire connecting cable, **04** per ft., extra.

300 OHM T.V. LEAD IN $12.95

Best quality 300 ohm TV lead in wire, 55 mil polyethlene with 22 gauge stranded copper conductors. Will not crack and break up in extreme heat or cold. Genuine Plastoid branded, new surplus. Stock No. P-3126. **$12.95** per 1000 ft. metal spool. Open line TV lead in. Copperweld, 1/6 the loss of regular 300 ohm. For fringe area reception. **$4.95** per 100 ft. 250 ft. for **$12.00.** 500 ft., **$22.95.**

1952 MODEL ASTATIC $19.10

New Astatic "Seanafar" TV booster with improvements over all the best TV receivers. Minimum noise with maximum gain. Balanced cascaded circuit with 6J6 and 6BQ7. Input and output for both 72 and 300 ohm. Mahogany finished metal cabinet 6¼x4¼x4¾" high. Model CT-1. Net price **$19.10.**

1952 MODEL REGENCY $19.10

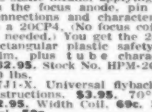
New Regency DB-520 TV booster with exclusive circuit stabilizer and newly designed cabinet only 4½x6x4½". Improved circuit with push-pull 6J6 is equal to the best cascode circuits and has higher gain. Matches 72 or 300 ohm. Net price **$19.10.**

CUSTOM BUILT TO FIT AUTO RADIOS

6 tube superheterodyne 3 gang tuning. Custom Built to fit individual makes of cars. Simple to install, no cables or drilling necessary. Packed in original factory cartons.

Made for	List Price	Your Price
'49 and '50 Ford	$59.95	$39.97
'49, '50 Dodge, Plymouth	59.95	39.97
'49 & '50 Chevrolet	59.95	41.97
1951 Ford	59.95	39.97
1952 Ford	59.95	39.97
'51 and '52 Dodge	59.95	39.97
'51 & '52 Chevrolet	59.95	39.97
'48 thru '52 Hudson	59.95	39.97
'50 thru '52 Studebaker	59.95	39.97
'51 & '52 Plymouth	59.95	41.97
1951 Henry J.	59.95	39.97
Universal Underdash	49.95	32.97

NOW YOU CAN CONVERT TO A 17" OR 20" PICTURE TUBE WITH ELECTRO STATIC FOCUS



The 17HP4 and 20HP4 are 17" and 20" black face picture tubes of the electromagnetic deflection electrostatic type of focusing. Focusing is accomplished by a 5 meg. pot connected as a bleeder between ground and the cathode of the damper tube. The arm of the focus pot connects to pin 6 of the CR tube, to apply a focus voltage of from 0 to 300 volts. This new type tube is called low voltage electrostatic focus. Very similar to the 2nd generation 7" tube and other set makers are using this new tube in several models. The trend is almost completely to this type gun.

20" CONVERSION KIT $32.95

The new 20HP4 blackface picture tube operates from 10 to 14KV. high voltage. It is the conventional 20° rectangular shape. A standard 70° yoke and related parts are required. Focusing is accomplished by electro-static means, applying from 0-300 volts on the focus anode, pin No. 6. All other connections and characteristics are similar to a 20CP4. (No focus coil or focus magnet is needed.) You get the 20HP4 tube, a 20° rectangular plastic safety mask with gold trim, plus tube characteristics, all for **$32.95.** Stock No. HPM-20, shipping weight 40 lbs.

77J1-X. Universal flyback with connecting instructions. **$3.95.** 70° Deflection Yoke, **$2.95.** Width Coil, **69c.** 5 meg. focus control. **59c.**

17" CONVERSION KIT $24.95

The new 17HP4 blackface picture tube operates from 8 to 14KV. high voltage. It is the conventional 17° rectangular shape. A standard 70° yoke and related parts are required. Focusing is accomplished by electro-static means, applying from 0-300 volts on the focus anode, pin No. 6. All other connections and characteristics are similar to a 17HP4. (No focus coil or focus magnet is needed.) You get the 17HP4 tube, a 17° rectangular plastic safety mask, with gold trim, plus tube characteristics, all for **$24.95.** Stock No. HPM-17. Shipping weight 30 lbs.

77J1-X. Universal Flyback with connecting instructions. **$3.95.** 70° Deflection Yoke, **$2.95.** Width Coil, **69c.** 5 meg. focus control. **59c.**

14" CONVERSION KIT $19.95

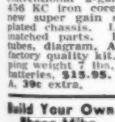
You get an RCA 14" rectangular blackface picture tube, plus a 14" plastic safety escutcheon, plus a 70° deflection yoke, plus a 14,000 volt flyback transformer, all for **$19.95.** Stock No. RC-14X Conversion diagram furnished.

10" PICTURE TUBE $14.95

10MP4, 10" picture tube made by Sylvania. Perfect replacement for 10BP4, no circuit changes required. Brand new factory cartoned. Net price 10MP4, **$14.95** each.

COMPLETE RADIO, TELEVISION AND AMPLIFIER KITS AT McGEE

3-WAY PORTABLE KIT $15.95



A NEW '52 MODEL

New 1952 Model 3-way personal portable radio kit. Operates on 110 Volts AC-DC or 67½ B plus 1½ volt self-contained batteries. Leatherette covered case size, 5½x5¾x8". Receives broadcast 550 to 1650 KC. conventional 2-gang superhet circuit with 456 KC iron core IF's. Incorporates the new super gain stable loop antenna. All plated chassis. Lab. approved circuit—matched parts. Price includes all parts, tubes, diagram, Alnico V PM speaker. A factory quality kit. Stock No. PS-4T, shipping weight 7 lbs. The complete kit, less batteries, **$15.95.** 67½ V. B. **$1.59;** 1½ V. A. **39c** extra.

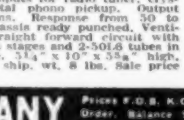
Build Your Own Phono-Mike Broadcaster $7.95

Kit Model DE-6R. With this simple kit, you can build a 3-tube phono oscillator that also has a mike input. Will broadcast over any radio within your home, (about 75 feet) from 1000 to 1500 kc. Inputs for crystal mike or crystal phono pickup. Fader control fades from mike to record. Ideal for a home P.A. system, baby listener and home entertainment. A complete kit of parts including tubes, Kit Model DE-6R. Net price, **$7.95.** DE-6RWT. wired and tested. Net price, **$9.95.** Crystal mike and desk stand. **$4.95 extra.** Concealed microphone unit, only 1" in diameter and ¼" thick. Specify hidden mike when ordering. Stock No. T-001. Net. **$3.95** extra.

8-Tube Hi-Fi Amplifier Kit $29.95

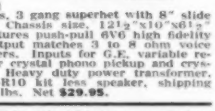
A complete kit, including tubes: 3-7E5, 2-6A3, plus rectifier diagram and photos. Inputs for radio tuner and any kind of phono pickup. Crystal or G.E. variable reluctance and either crystal or dynamic mike. Output matches 8 ohm voice coil. Twin electronic bass and treble tone controls with range selector switch for either juke box quality with heavy bass response or brilliant symphonic range. Response 18 to 20,000 cps. 8 tube all triode amplifier kit, complete with tubes. Shipping weight 25 lbs. Model TX5. Net **$29.95.**

10-Watt Hi-Fi Amplifier Kit $14.95



A complete kit of parts including tubes 12AX7, 12AU7, 2-5016, rectifier, diagram and instructions to build a high fidelity wide tone control audio amplifier with bass and treble boost. Inputs for radio tuner, crystal mike and crystal phono pickup. Output matches 8 ohms. Response from 50 to 15,000 cps. Chassis ready punched. Ventilated cover. Straight forward circuit with twin triode grain stages and 2-5016 tubes in push-pull. Size, 9¼" x 10" x 5⅝" high. Model AP-10H, ship. wt. 8 lbs. Sale price **$14.95.**

10-TUBE RADIO KIT $29.95



10 tube broadcast radio chassis kit, complete with tubes: 2-6SK7, 6SA7, 6H6, 6SQ7, 2-12AX7, 2-6V6 plus rectifier, diagram and instructions, 3 gang superhet with 8" slide rule dial. Chassis is 12½"x10"x6½" high. Features push-pull 6V6 high fidelity audio. Output matches 3 to 8 ohm voice coil speakers. Inputs for G.E. variable reluctance or crystal phono pickup and crystal mike. Heavy duty power transformer. Model BK-R10 kit less speaker, shipping weight 18 lbs. Net **$29.95.**

6-TUBE 2-BAND KIT $14.95

Popular with schools and colleges for training. 6 tube AC-DC, 2 band radio kit with plastic cabinet. Receives broadcast and 6 to 18 mc shortwave. Full 2 gang superhet with 5" speaker and slide rule dial. A complete kit with tubes: 12SK7, 12SK8, 12SK7, 12Q7, 6V6 and 35Z5, diagram and instructions. Factory quality. Cabinet size 13"x6¾"x8¼". Shipping weight 12 lbs. Model ME6-2. Net **$14.95.**

5-TUBE AC-DC KIT $12.95

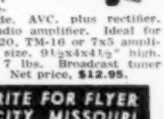
Model RS-5. A 5 tube AC-DC straight broadcast kit, housed in the same cabinet as ME6-2 above. Complete with tubes. Shipping weight 10 lbs.. Net **$12.95.**

17, 20" T.V. Kit $59.95 Less Tubes

A complete kit of parts to build an AC transformer operated television chassis for use with a 16" to 20" rectangular picture tube. The 12 channel Sarkes-Tarzian tuner is ready wired, as is the 4 tube video IF strip. Circuit is of the conventional design. Do not buy this unless you understand Television. It is difficult to wire. We furnish schematic. Kit model WH-20. Ship. wt, 40 lbs, less all tubes. Net **$59.95.**

Kit of 22 tubes, less picture tube **$16.95.** 17" 17BP4A, **$19.95.** 20HP4, **$25.00.**

AC POWERED BROADCAST TUNER KIT $12.95



A self-powered, 3-gang superhet tuner kit with R.F. stage. This complete kit is furnished with a diagram, photos and tubes, 6AU6 R.F., 6BE6 oscillator R.F., 6AU6 I.F. detector, 6AL5 diode, AVC, plus rectifier. Connect to any audio amplifier. Ideal for use with our S-2020, TM-16 or 7x5 amplifier kits. Chassis size, 9½x4x4½" high. Shipping weight, 7 lbs. Broadcast tuner kit Model BT-38X. Net price, **$12.95.**

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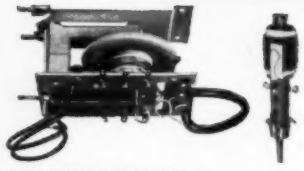

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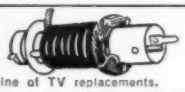
(3-27 MH) A Tapped Secondary For AGC or AFC.



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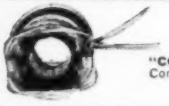

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Complete with leads & network.

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Full technical data packed with every item.
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*Merit is meeting the TV improvement, replacement and conversion demand with a line as complete as our advance information warrants!

Signal Tracing Probe

(*Continued from page* 59)

from poor sync stability to "over-contrasty" pictures lacking in definition. In most cases, the exact cause of the complaint is difficult to find, especially when using conventional servicing techniques.

Where a signal tracing technique is used, on the other hand, distortion is readily apparent as a change in the detected video signal.

Either the top or bottom (or both) of the video signal may be flattened or clipped. See Fig. 5C. Where the top of the video signal is flattened, as at 1 in Fig. 5C, the complaint will be either loss of sync or sync instability. Sync instability usually shows up first in the horizontal sweep circuits.

Where the picture portion of the composite video signal is flattened or clipped, as at 2 in Fig. 5C, the uneven and jagged video signal is replaced by a bright and straight line. The "body" of the signal will still be shaded, however. With this type of distortion, the picture will lack definition and may be over-contrasty.

Under some circumstances, both types of distortion may occur at the same time—compare the distorted video signal in Fig. 5C with the appearance of the "normal" video signal of Fig. 5A, noting particularly the differences in the top and bottom portions of the signal.

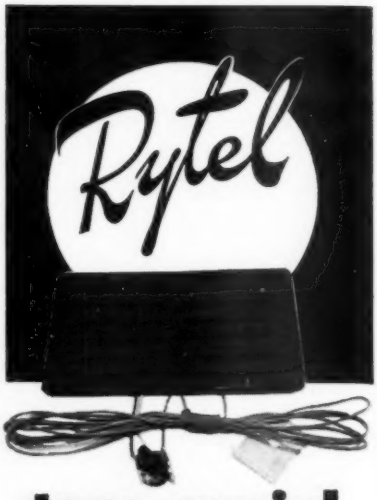
Distortion may be caused by incorrect operating voltages, a defective tube, too strong an input signal, improper operation of the a.g.c. circuit and similar defects. Once the distortion is isolated to a specific stage, using the probe, it is a simple matter to identify the exact cause of the trouble by making voltage checks and trying a substitute tube.

Under some circumstances, distortion may cause the output signal amplitude to be less than the input—a symptom similar to that obtained with a "weak" stage. Extreme overload may cause a reversal in signal phase due to detector action in the i.f. stage itself.

Since the detection of the i.f. normally takes place in the probe, the video signal seen on the screen of the CRO will maintain the same phase relationship regardless of which i.f. stage is being checked. If the pulses are at the top of the video signal (on the scope screen), they should remain there regardless of the point at which the probe is touched in the i.f. strip. If detection occurs in one of the i.f. stages, on the other hand, the video signal may be seen to reverse phase on the screen of the CRO when that stage is checked.

As experience is gained in using the probe, the technician will soon be able to tell the most probable cause of the distortion from the appearance of the distorted video signal.

—30—



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Within the Industry

(*Continued from page* 26)

The move provides additional facilities for the manufacture of the company's line of relays, thermostats, etc. . . . **AJAX CONDENSER CO., INC.** of Chicago has opened a West Coast factory at 10905 Chandler Boulevard in North Hollywood, California. The new firm will be known as **AJAX CONDENSER CORP.** and will supply condensers for the electronic and electrical industries on the West Coast . . . **ALPHA METALS, INC.** has a new address. The firm is now located at 56 Water Street in Jersey City, New Jersey. The mail address is P.O. Box 34, Bergen Station . . . **GENERAL ELECTRIC COMPANY** is building a multimillion dollar transformer manufacturing plant in Rome, Georgia. Completion is scheduled for mid-1953. The plant will provide employment for about 1700 persons . . . **JERSEY SPECIALTY COMPANY,** manufacturers of TV lead-in wire, etc., is scheduled to move into its new and modern plant on Route 23 in Mountainview, New Jersey by mid-September. The new factory will provide 1250 square feet of manufacturing space . . . **COLUMBIA BROADCASTING SYSTEM** has purchased a depot and office building at West 56th Street in New York which will be converted into the largest TV programming plant on the Atlantic seaboard. The present building contains over 405,000 square feet of floor space.

* * *

H. EVERETT SMITH has been named president of *The Wilcox-Gay Corporation* and *Garod Radio Corporation* of Charlotte, Michigan, and Brooklyn, New York.

Mr. Smith recently resigned his position as senior vice-president of the *Marine Midland Trust Company* of New York to accept this new post. He will occupy the position formerly held by Leonard Ashbach, who continues as chairman of the board of directors of the two companies and chief executive officer.

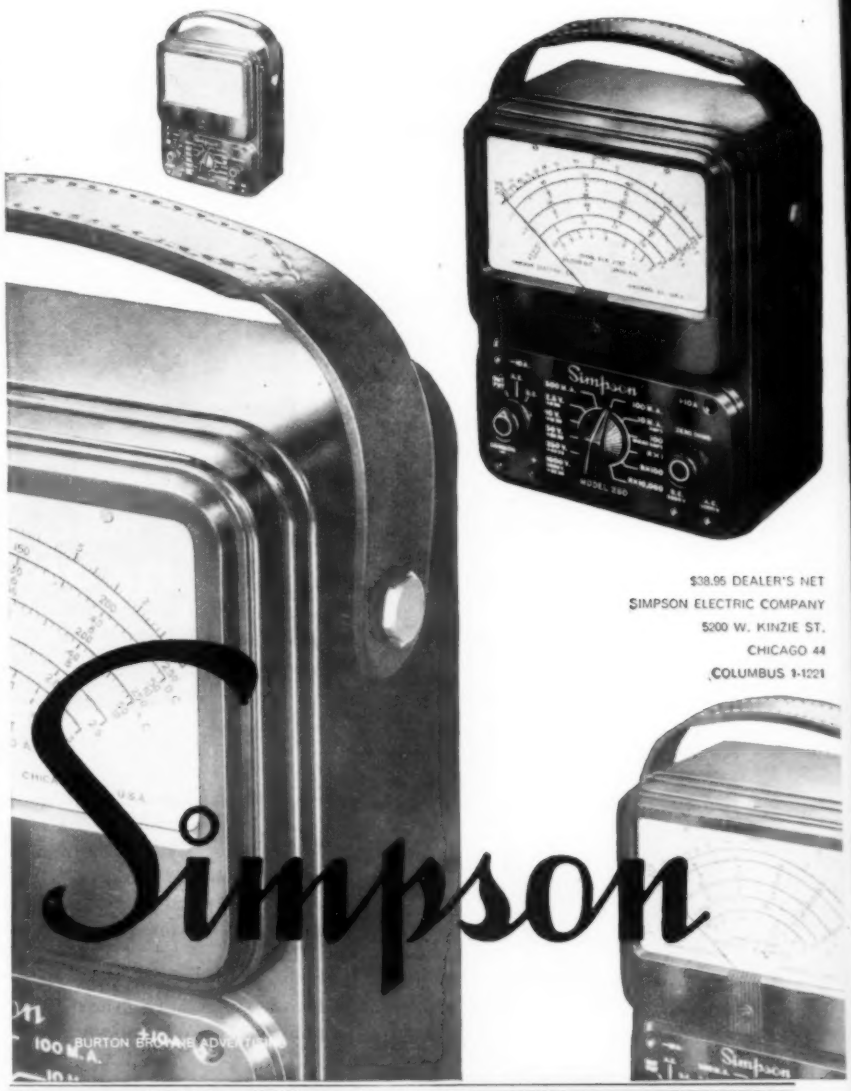
Mr. Smith had been associated with the *Marine Midland Trust Company* for a period of 11 years and prior to that served 14 years with the *Manufacturers Trust Company.* He will maintain offices at the company's Brooklyn plant at 70 Washington Street.

* * *

JOHN Q. CANNON, assistant secretary of *Radio Corporation of America,* has been named secretary of the company by the board of directors. He has been with the company since 1945 . . . The French Government has conferred the rank of Chevalier in the National Order of the Legion of Honor on **DR. ALLEN B. DU MONT.** The honor was bestowed in recognition of his services on behalf of the Allied cause during

outsells all others combined

MODEL 260 VOLT-OHM-MILLIAMMETER



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AMAZING NEW TRANSMITTING-RECEIVING STATION

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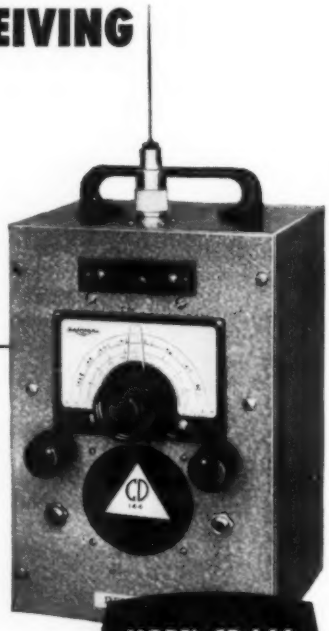

plugs into ordinary 110V AC receptacle...6V battery or auto cigar lighter

Now, you can have a completely portable, transmitting and receiving station that operates from either a fixed or mobile location, for only a fraction of the cost you ever thought possible. Today, the new Deltronic simple, low-cost unit makes all other complicated systems obsolete.

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World War II, through his scientific work, and for his contributions to commercial relations between the U. S. and France . . . **HENRY MARKS** has been named assistant general manager of *Jerrold Electronic Corporation* of Philadelphia. He has been with the firm since 1948 . . . **AL FRIEDMAN** is the new national field sales engineer for *Ram Electronics Sales Co.* He has been associated with several well-known electronics firms and is familiar with all phases of the radio and electronic industry . . . **DONALD C. CARTER** has joined *The Magnavox Company* as assistant to the president. He joins the Fort Wayne firm after three years as a plant manager for *Ford Motor Company* . . . **THOMAS F. JOYCE** has been elected president of *Raymond Rosen & Company, Inc.* and the *Philadelphia Appliance Service Corporation.* Prior to joining the distributing firm in 1945, he served in various executive capacities with *Radio Corporation of America* . . . **DARRELL KNIGHT** has been named manager of trade press relations for *Motorola Inc.* He succeeds **DALE SAMUELSON** who has left the company to accept a position as national sales promotion manager for a well-known electronics manufacturer in the East . . . The board of directors of *P. R. Mallory & Co., Inc.* has elected **FRANK B. POWERS** to the post of vice-president in charge of manufacturing. He was formerly associated with *Federal Telephone and Radio* where he was vice-president in charge of operations and a member of the board of directors . . . **SAMUEL B. WILLIAMS** has been named assistant to **PRESIDENT DON G. MITCHELL** of *Sylvania Electric Products Inc.* He has been director of public relations for the firm since 1949 . . . **ED FALLS** is the new regional manager for *Motorola's* southwest sales area. He will cover the states of Texas, Oklahoma, Arkansas, Louisiana, and New Mexico . . . **VIRGIL B. DAY** has been named manager of employee and plant community relations for *General Electric Company's* receiver department . . . **JACK ABEL** has joined the *Insuline Corporation of America* where he will take charge of the company's mechanical engineering department . . . *CBS-Columbia, Inc.* has appointed **BERNARD M. DOVER** to the post of project engineer. He was formerly associated with *Emerson Radio and Phonograph Corporation* in charge of its tuner department . . . **IRVING HERRIOTT, JR.**, district sales manager for *Zenith Radio Corporation,* passed away recently while in Washington, D. C. on a business trip. He had been associated with the firm since 1937 . . . **GEORGE W. HENYAN** has resigned as chief of the components branch of the National Production Authority's Electronics Division to rejoin *General Electric Company* as assistant to the general manager of the Tube Department . . . **JAMES M. SKINNER, JR.** has been named vice-president-distribution for all domestic divisions of *Philco Corporation* of Philadelphia.

-30-

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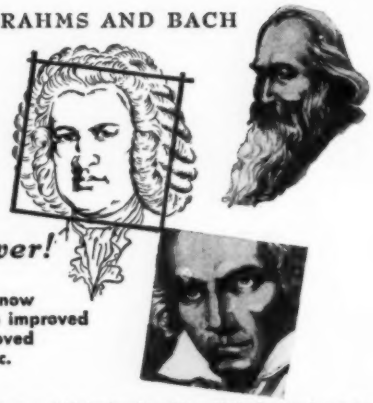
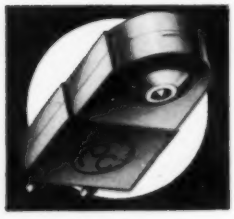


Yes, Bach, Beethoven and Brahms are now better than ever—we don't mean we've improved their music, but we *do mean* we've improved the reproduction of their *recorded* music.



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2 piece, 5 pole Male and Female separable Amphenol plugs. Both with Flex. shielded cables. Approx. 5 ft. long. 35c pair.....3 pr. for $1.00

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Trimmer-Padder Asst.—all isolantite—singles, dual; triples—100 asst.....$2.25

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RCA Ass't Mica By-Pass Cond. .001. 100 for...95c
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SALE—PHONO RECORD ALBUMS—12"—3 comp. 15c; 10"—3 comp.—15c; 4 comp. 20c; 12 comp. 69c

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INEXPENSIVE
XTAL-CONTROLLED
2-TUBE KIT for the BEGINNER!
Complete with Power Supply!

Arrow Electronics has brought out in kit form all the parts needed to build the novice or beginner's crystal-controlled 80 meter transmitter described on pages 154-158 in the 1952 Radio Amateur's Handbook. Arrow has modernized it so that the entire unit, including power supply, will mount on one metal chassis. Simple to wire, almost anyone can assemble it in a few hours. Operates with almost any random length of wire as antenna.

Look At These Many Features!

- 10 Watts Input
- 350 V. Power Supply
- 0-100 Ma DC Meter
- Xtal-Controlled, 3700-3750 Kc
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- Built-in Antenna Tuner
- Built-in Keying Jack
- 80 Meter Operation
- Uses 6AG7 & 6X5 Tubes

COMPLETE KIT of PARTS only $19.95 less crystal wire & solder

Prices f. o. b. N. Y. 25% deposit with C.O.D. orders

Complete kit of parts, including 2 tubes, blank aluminum chassis, template, 80 M. coil, condensers, resistors, meter, power supply components, chokes, lugs, wiring diagram and instructions, etc., less wire, solder and crystal.....$19.95
80 meter crystal.....additional $2.70

W2PGP • W2JRF • W2UG2 in attendance will help you with any of your "ham" problems.

ARROW ELECTRONICS INC. Phone DIGBY 9-4714
82 CORTLANDT ST., Dept. C, N. Y. 7, N. Y. • Cable "ARELECTRO - N. Y."

Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

NEW MACHINE BROCHURE

Chicago Rivet & Machine Co., 9600 W. Jackson Blvd., Bellwood, Illinois, is currently offering copies of its two-color broadside which describes in detail the company's new No. 214 double riveter.

This unit, which is suitable for various types of assembly work, can set two rivets at a time on either one of two selected fixed centers. The foot-operated pneumatic control instantly shifts one riveting head from one selected riveting position to the other at the will of the operator. Adjustable stops permit a wide selection of any desired riveting centers ranging from ⅝" to 2½" with a maximum of 6".

The new bulletin describes in detail the operation and setting up of the unit and lists complete specifications. A copy of the broadside is available without charge from the company direct.

STEEL FASTENINGS

A new 20-page catalogue which provides detailed product specifications to aid in selecting and ordering stainless steel fastenings has just been issued by *Star Stainless Screw Company*, 195 Union Avenue, Paterson 2, New Jersey.

Illustrations of the products in each classification quickly identify the various items. Specifications such as measurements and materials are clearly listed in easily-read chart form. The product categories include all types of screws, nuts, bolts, washers, pins, studs, rivets, nails, etc.

On the four pages devoted to stainless steel specialties, diagrammatic drawings are provided to fully describe the various fittings. In addition, several pages are devoted to decimal equivalents of pertinent fractions and the structural quality and suitability of the standard stainless steels.

HAM BOOKLET

A little booklet, designed to stimulate interest in becoming a ham, has been issued by the American Radio Relay League, West Hartford 7, Conn.

Entitled "You Can Be There," the booklet describes many international adventures awaiting amateur operators and points up one highlight of recent years—direct radio contact with "Kon-Tiki."

Distribution of the first 100,000 copies of the pamphlet will be through youth

organizations, educational and civic groups, and electronics manufacturers and distributors.

SNAP-ACTING THERMOSTATS

Stevens Manufacturing Company, Inc., 69 S. Walnut Street, Mansfield, Ohio, is currently offering copies of a new illustrated bulletin on the company's line of snap-acting thermostats for operation on wide or narrow differentials.

In addition to suggested applications, the bulletin describes the operating principle and illustrates it with schematic diagrams. Ratings, typical performance curves, dimensions, and construction data are included.

Copies of Bulletin L-4144 will be forwarded without charge to those making their requests direct to the company.

TEST LAMP DATA

Details on the company's "Bull's-Eye" lamp are included in the new bulletin just released by *Lindly & Co.*, 248 Herricks Road, Mineola, N. Y.

The lamp, which has been especially designed for close work and assembly operations, is illustrated and its advantages and construction features described.

Copies of the bulletin are available without charge.

FLASH HANDBOOK

A new 16-page handbook on home construction of electronic flash equipment for amateur photographers has been published by *Sprague Products Co.*

The new publication gives complete circuit details on four different photoflash units using the company's new Type FF-1 low-leakage condensers, rated at 525 μfd., 450 volts in a can 2" in diameter by 4½" long.

Copies of the "Electronic Flash Handbook," Form C-703, are available from all *Sprague* distributors for 35 cents or may be obtained by sending 35 cents in coins or stamps directly to the company at 51 Marshall Street, North Adams, Massachusetts.

PYRAMID CATALOGUES

Pyramid Electric Company, 1445 Hudson Boulevard, North Bergen, New Jersey, has announced publication of four new catalogues which provide specifications, construction and engineering data, sizes, and prices on the company's line of condensers.

Catalogue PG-1 lists miniature "Glasseal" condenser types PGH, PGM, and PGX. These units operate at temperatures ranging from −55 degrees to +125 degrees.

Catalogue IMP-1 describes the company's newest line of molded plastic tubular units. The "IMPS" are impervious to moisture and will withstand a temperature of 100 degrees C.

Catalogue MP-2 gives detailed information on the company's ultra-compact metallized paper types while Catalogue J-7 is a 32-page compilation of paper, electrolytic, oil-paper, and metallized paper condensers.

SERVICEMAN'S DIARY....by Ben Grim
HI'YA GEORGE! LONG TIME, NO SEE! HOW'S ABOUT BRINGING THE MRS. OVER TO DINNER TOMORROW EVENING!
SMITH'S RADIO-TV SERVICE
A NICE INVITATION FROM JAKE McSUCH
SINCE THE TV'S ON THE FRITZ, I SUPPOSE WE CAN PLAY BRIDGE!
LAST WEEK, WHEN THE BABY WAS SICK, WE HAD THE DOCTOR FOR DINNER!
NONSENSE!... GEORGE HERE, CAN GET THE SET WORKING IN A JIFFY.. CAN'T YOU, GEORGE?
...BUT, AFTER DINNER...COMES THE TOUCH!
THANKS TO ED RAMIREZ, LOS ANGELES, CAL.

NEW!

UNIVERSAL REPLACEMENT HI-VOLTAGE "DOORKNOB" CERAMIC...

FURNISHED WITH

SCREW-IN TERMINALS TO MEET EVERY NEED!

An ingenious screw-in terminal system makes Sprague's new type 20DK-T5, 500 mmf, 20,000 volt molded case ceramic capacitor fit most *every* TV set. All you have to do is select the proper set of terminals, two twists of the wrist, and there you are!

With this new Sprague development, you need only one capacitor in your kit to service sets up to 21" tubes.

Sprague's 20DK-T5 "Doorknob" ceramic is molded in genuine thermosetting plastic, non-flammable and moisture-resistant. Guard rings are molded in both faces to lengthen the surface leakage path. Write for complete catalog C-608 to Sprague Products Co., 51 Marshall St., North Adams, Mass.

SPRAGUE®

Don't Be Vague!
Insist On Sprague

WORLD'S LARGEST CAPACITOR MANUFACTURER

Free copies of any or all of these catalogues are available on letterhead request to the company.

ELECTRONIC WATTMETER

Keithley Instruments, 3868 Carnegie Avenue, Cleveland 15, Ohio, has released a two-page bulletin which describes its Model 109 electronic wattmeter in some detail.

The new unit, which is especially useful where a high input impedance or sensitivity to low-voltage and low-power circuits are required, is described fully. Specifications and suggested uses are also outlined.

Copies of the bulletin will be supplied without charge on request.

RIDER CATALOGUE

John F. Rider Publisher, Inc., 480 Canal Street, New York, New York, now has copies of its revised catalogue available for distribution.

The 8-page, 8½" x 11" catalogue contains a complete up-to-date listing of the company's Manuals, "Tek-File", and books. Information on the company's books to be published soon is also included.

Copies of the catalogue are available from the organization's distributors or directly from the publisher.

CLIP BULLETIN

Prestole Corporation of Toledo, Ohio, has just issued a data sheet covering its new and improved condenser clip.

The new bulletin provides complete descriptive data and specifications on the seven different sizes of clips now currently available.

Copies of the bulletin, along with a price list, will be mailed to executives, engineers, and purchasing agents who make their requests on their company letterheads.

CONVERTER CATALOGUE

Carter Motor Co., 2644 N. Maplewood Avenue, Chicago, Illinois, has released a new catalogue which lists its entire line of d.c.-to-a.c. converters.

This 16-page catalogue provides complete electrical and mechanical specifications, the company's selector chart which has been revised to contain the latest in television and recording equipment, and a complete directory of the company's sales representatives.

The new publication is punched to fit all standard loose-leaf binders. Copies are now obtainable from the manufacturer. Ask for Catalogue No. 452.

HAMMARLUND CATALOGUE

The Hammarlund Manufacturing Company, 460 West 34th Street, New York 1, New York, has announced publication of a new 1952 condenser catalogue which is being offered to electronic manufacturers, the military services, research and design engineers, and other interested individuals and groups.

This detailed and illustrated two-color, 12-page brochure includes complete drawings and electrical and mechanical specifications covering a broad selection of standard variable air condensers. The items described are stock items which are available from jobbers and dealers throughout the country.

Requests for copies of this catalogue should be addressed direct to the company.

TV CATALOGUE

The LaPointe Plascomold Corporation, Windsor Locks, Connecticut, now has available copies of its 1952 *"Vee-D-X"* TV catalogue which are being offered to service technicians and others concerned with television installations.

The new catalogue contains a complete listing of the company's antennas and accessories. Containing 24 pages and printed in two colors, the catalogue features not only the company's standard products but its special developments in the television field.

First released at the Radio Parts Show in Chicago, the new catalogue is being distributed by *"Vee-D-X"* representatives and jobbers. Copies may also be obtained from the company direct.

VIBRATOR REPLACEMENT

A complete and concise replacement vibrator guide has just been issued by

OLSON'S PENNY PROFIT POLICY MEANS GREATER BARGAINS

DON'T MISS THIS AMAZING VALUE

MAJESTIC
DIV. OF WILCOX-GAY
8-TUBE AM-FM
RADIO CHASSIS
$44.95 EA.
Stock No. RA-52A
LATEST MODEL
Complete: Tubes, Loop Antenna, Escutcheon, Knobs, etc.

This is not a kit or a tuner. It's a real high-powered AM-FM Radio Chassis that will pull in distant stations with amazing volume and brilliance of tone. Makes a perfect custom installation in existing cabinets, book-cases, walls, etc. Servicemen and Experimenters: Make money installing these for friends and customers.
The circuit is modern and employs 8 tubes (12AT7, 6BE6, 2-6BA6, 6AL5, 6AV6, 6V6 and 5Y3). The entire R. F. assembly and the 4-section tuning condenser is rubber mounted. Tuned R. F. stages plus two I. F. stages give this set terrific FM sensitivity. Separate FM oscillator tube for extreme stability, and triode R. F. and mixer circuits plus radio detector assure noise free, high fidelity FM reception.
Two modern dual knobs control on-off, volume and tone plus AM-FM, phone switch. Equipped with two panel lamps and edge lit dial. Phono input socket and AC receptacle at rear of chassis. Chassis size 13" wide, 7½" deep, 7½" high. Cut out in cabinet requires 8x3¼. Output impedance 8 ohms operates on 110-125v AC, 60 cycles. Shpg. wt. 20 lbs. In factory sealed cartons.

COMBINATION DEAL
RADIO AND 12" CO-AXIAL SPEAKER
You get the above Majestic AM-FM Radio chassis exactly as described above PLUS a model S-168A 12" Co-axial speaker, 1952 model, as described on opposite page. Both packed in factory sealed cartons.
$49.95 DEAL NO. RA-52SBA

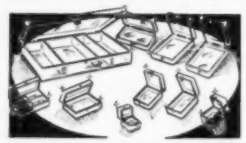
$8.95 No. RA-101A

PHONO PRE-AMPLIFIER
For use with G.E. and other low level magnetic pickups. Can be attached to any radio or amplifier. Built on aluminum chassis, finest workmanship throughout. Ample bass boost provided. Operates on 115 volt AC. Sizes 4¼"x2⅛"x3½". Complete with 12AX7 tube. Shpg. wt. 2 lbs.

10 WATT HI-FI PUSH-PULL AMPLIFIER

$32.95 with Tubes
Stock No. RA-102A
- Bass & Treble Boost.
- Inputs for crystal and magnetic pickups, radio tuner and crystal mike.
- Aluminum Chassis.

Bombshell Value! It's unbelievable. A full 10 watt Hi-Fi Amplifier, completely assembled and ready to play. Has built-in PRE-AMP for G.E. and similar types of magnetic pickups. 4 Inputs: 1 crystal phono, 1 magnetic phono, 1 radio, 1 mike. 4 Controls: 1 Bass, 1 Treble, 1 Volume, 1 Phono-radio Switch. Output Impedances: 4, 8, 16 ohms. Peak power output 17 watts.
Order this amplifier today and see what brilliant, realistic tone it will deliver. Supply is limited. Everyone in factory sealed carton. You couldn't buy the parts alone for this price. Remember this is a full size amplifier, transformer operated, not an AC-DC job. Frequency response 20 to 20,000 cps at less than ½ of 1% distortion. 5 Tubes: 1-6SL7, 1-6SC7, 2-6V6, 1-5Y3. Complete with tubes. Size 12"x6½"x5½". Shpg. wt. 15 lbs. Can be used with any phono or speaker.

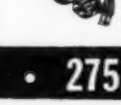


TRANSPARENT BOXES
Stock No. AS-65A
$1.95
Complete set of 10 assorted sizes ....
Made of Styron, the miracle plastic. Clear as glass but won't break with ordinary use. You get 10 different, all popular size boxes. All with hinged covers. Boxes range from 8" x 3¾" x 1½" to 1" x 1" x ½". Handy for nuts, bolts, lugs, resistors, small parts, etc. Get several kits today. Shpg. wt. 2 lbs.

1c
With every Kit of Transparent Boxes you order you can get an Allied .1 mfd 600 volt Condenser—retail value 45c—your cost only 1 cent.

PLASTIC RECORDING TAPE
Get the buy of your life. Save up to 64% on high quality RECORDING TAPE. A large manufacturer had to sell his inventory and be unloaded the whole deal. Olson now offers you this high grade recording tape at prices which defy competition. Standard ¼" wide. Frequency response 50 to 8,000 cy. Plastic Reel included with each.
600 Ft. Reel Stock No. X-275A. Single, each $1.40, LOTS OF 10, $1.29 EA. .....
1200 Ft. Reel Stock No. X-248M. Single, each $2.10, LOTS OF 10, $1.99 EA. .....

1c
With every 10 rolls of Plastic Recording Tape you order, you can get a 50 ft. roll of hook-up wire—retail value $1.00—your cost only 1 cent.



Don't Throw Away Old Picture Tubes
You can get excellent pictures on old dim kinescopes for an additional 900 to 3200 hours by simply attaching the new Perma-Power TV Tube "Britener." Fully automatic. Just plugs onto back of old TV Tube. Not a gadget. Laboratory tested and approved. Regular retail price $9.75. Order yours now. Make big money selling TV "Briteners" to your friends and customers. Shpg. wt. 3 lbs. Stock No. T-98A ..... ea. **$5.73**
USE ORDER BLANK ON NEXT PAGE

1c
With every TV Tube Briteners you order, you can get a 10,000 volt TV Condenser—retail value $1.25 — your cost only 1 cent.

OLSON RADIO WAREHOUSE • 275 E. Market St., Akron 8, Ohio

GIANT 1¢ SALE

READ EVERY WORD — LOOK WHAT 1¢ BUYS

5" ALNICO 5 PM SPEAKERS

Order Stock No. S-169A

1st Speaker. $1.79
2nd Speaker. 1.79
3rd Speaker. 1.79
4th Speaker. .01

All Four For $5.38

1¢ SPEAKER SALE

- Thousands have been sold by Olson for $1.79
- We must make room in our warehouse

Buy 3 and get the 4th for only 1¢

At 1¢ Olson will sell plenty of 5" PM Speakers. No one else would dare make this offer. But our new Fall merchandise is coming in any day now and we need ROOM. Buy 3 speakers at our bargain price of $1.79 each and get the fourth speaker for only 1c. Order 6 speakers at $1.79 each and get 2 speakers for only 2c additional. Remember, for every 3 speakers you buy, an additional speaker is only 1c. Don't miss this offer. It CANNOT be repeated when sold out. Every speaker is brand new in original factory cartons. Full 5" diameter. Dustproofed inside and out. Alnico 5 magnet. Voice coil 3.2 ohms. The perfect speaker for extension speakers, auto sets, AC-DC radios and intercoms. Shpg. wt. per speaker 1 lb.

12" CO-AXIAL SPEAKER

$12.95

Stock No. S-168A

Our new 1952 Model. Guaranteed to outperform any speaker in its price class. Equipped with two "high concentration" Alnico 5 magnets and a high frequency diffuser. The 12" section delivers the bass while the inner 3" tweeter speaker section delivers the treble tones. Together they give you "living tone." This speaker is unconditionally guaranteed to satisfy even the most critical user or Olson promises to refund your money. Only two wires to connect to any radio or amplifier. Voice coil impedance 8 ohms. Frequency response 30 to 17,500 cps. Shpg. wt. 10 lbs.

1¢ With every S-168A Coaxial Speaker you order, you can get a line matching transformer to match a 500 line to any speaker—retail value $3.00—your cost only 1 cent.

2-STATION INTERCOM SYSTEM

Stock No. RA-96A

Olson Special Price for Master Station Substation and 50 ft. of cable only

$19.83

PRESTO—Call Intercom

The Modern Electronic Communication System

Now talk with anyone, anywhere at the mere flick of a button! All electric master station and sub-station give clear, powerful voice reproduction to rooms or other buildings up to 1000 ft. away. Thousands have been sold for use in restaurants, on farms, offices, stockrooms, factories and in homes. Just plug master station into any 115 V AC electrical outlet—connect 3 wires and you're operating. Modern design. Each unit measures 4½x4½x5½. Equipped with rubber feet and easy slide switches. Handsome appearance—gray crackle finish. High amplification—use 3 tubes. Power output 2½ watts. Regular list price is $37.50. You get the master station, substation and 50 ft. of 3 conductor cable. Complete with tubes. Shpg. wt. 8 lbs.

1¢ With every 2-Station Intercom you order, you can get a Kit of 20 popular 10 watt Wire Wound Resistors—retail value $10.00—your cost only 1¢.

VM 2 SPEED AUTOMATIC RECORD CHANGER

Stock No. RA-99A Each $19.99

Now you can take advantage of this deal that Olson ran across. Incorporates the latest design to play the records in most demand, 33⅓ and 78. Records may even be intermixed on the spindle. Will hold twelve 10" or ten 12" discs in one loading. Records slide down the center shaft with utmost precision. Low pressure tone arm is equipped with an RCA turn-over cartridge and two permanent needles. Shuts off after last record. Has reject button also. Size 12" x 13". Operates on 115 volts AC, 60 cycles. Shpg. wt. 15 lbs.

1¢ With every VM Changer you order, you can get an approved 6 foot AC Cord with plug—retail value 75¢—your cost only 1 cent.

5 TO 50 WATT WIREWOUND KIT

• Contains 50 Resistors

Stock No. AS-63A

$3.49

Think of it. You get 50 brand new Wirewound Resistors in a wide range of ohmages from 5 watts to 50 watts. That's less than 7¢ each. These resistors would cost you at least $20.00 if bought separately. But Olson bought the entire stock of a tremendous manufacturer and you can cash in during this big summer sale.

1¢ With every Wirewound Kit that you order, you can get an 8 mfd 450 volt condenser—retail value $1.25—your cost only 1 cent.

NOTICE—RADIO MANUFACTURERS

Olson Radio has established a tremendous market among radio servicemen, amateurs, universities and industrials all over America as well as principal foreign countries. Our famous rapid mailing service is the talk of the trade.

If you have any good, clean surplus radio material which you wish to dispose of, contact Olson at once. We can use: Radios, amplifiers, condensers, chassis, phono motors, pickup arms, volume controls, test equipment, speakers, in fact any radio or electronic part or piece of equipment.

Here is your opportunity to turn idle inventory into cash. Write, wire or call Olson, the popular name in radio.

SEND FOR OLSON'S BRAND NEW BARGAIN CATALOG. GET NATIONALLY FAMOUS RADIO PARTS AND SUPPLIES AT BIG DISCOUNTS

CLEVELAND, OHIO
2020 Euclid Ave.
If you live in or near Cleveland visit our store, get these and many more bargains.

CHICAGO, ILLINOIS
623 W. Randolph Street
If you live in or near Chicago visit our store, get these and many more bargains.

MAIL ORDERS SHOULD BE SENT TO AKRON, OHIO

KINESCOPE TESTER

Tests all picture tubes Model 106A $29.95

At last you can test picture tubes quickly, easily and positively WITHOUT removing them from the chassis or cabinet. Tests magnetically and electrostatically focused picture tube and shows exact condition on a 3½" meter. Checks for: high voltage breakdown, leakage, gas between elements, conductance, high voltage on anode, screen or cathode to control grid voltage from set and brightness control voltage. Also has built-in ohm-meter and volt-meter with scales 0-500 and 15 KV. Complete with plugs, sockets and instructions. Shpg. wt. 7 lbs.

1¢ With every Kinescope Tester you order, you can get a kit of 24 assorted C-D and Solar By-pass Condensers—retail value $6.00—your cost only 1 cent.

STANDARD COIL TV BOOSTER

Model B-51A

$10.95

This is the latest model and only Olson is making this exclusive offer of 100 ft. of 300 ohm Polyethylene Twin Line for 1 cent with each Booster you order. The standard Coil TV Booster is the latest Model B-51 which regularly sells for $35.00. This offer will not be repeated when supply is gone. Brand new, factory-sealed cartons and fully guaranteed. This Booster has printed high frequency circuits and gives superior reception on all channels. Does not distort sound or picture but does give them tremendous boost. Perfect for fringe areas. Continuous one-knob tuning and channel selecting. If you have trouble with "snow" or if any channels are weak in your area—this booster will do wonders in overcoming these. Get brilliant, clear, "snow-free" pictures with this booster and get the 100 ft. spool of 300 ohm twin-lead for just 1 cent. Cabinet size 8" x 4½" x 4½". For 115 volt AC operation. Shpg. wt. 5 lbs.

1¢ With every standard coil TV Booster you order, you can get a big 100 ft. spool of 300 ohm poly twin-lead—retail value $5.00—your cost only 1 cent.

12" Magnavox Speaker and Baffle Close-Out

Stock No. AS-66A

Get both for only ...

$7.95

In lots of 4 sets. One set for $8.95.

You get Magnavox's fine 12" FM speaker with Alnico 5 magnet. (Same as you'll find in those expensive Magnavox Super-Radio-Phono Combinations.) Power output 8 watts. Voice coil fully dust-proofed. Impedance 6-8 ohms. In addition you get a walnut Speaker Baffle to bring out the full rich, rounded tones of the Magnavox Speaker. Baffle may be mounted on a wall or it will stand on a table. Here's the ideal combination for extension speakers for porches or other rooms. Can be connected to any radio or amplifier. Order 3 or more sets and install them in restaurants, auditoriums, halls, etc.

1¢ With every Magnavox Speaker and Baffle you order you can get a 50' roll of 2 conductor speaker extension wire—retail value $3.00—your cost only 1 cent.

$2.50 Phono Amplifier

Stock No. RA-98A

Shpg. wt. 3 lbs.

Only 1000 amplifiers to be sold by Olson during this sale at this remarkable low price. Efficient 2-tube amplifier. Input for crystal mike. Can be used with any PM speaker from 4" to 12". Delivers 3 watts of audio with excellent fidelity. Equipped with both volume control and tone control. Less tubes.

Kit of 2 tubes (35W4 and 50B5) for above amplifier. Both for $1.28

1¢ With every Amplifier you order you can get an output transformer—retail value $1.75—your cost only 1 cent.

IT'S EASY TO ORDER FROM OLSON'S

How to order: Order directly from this ad. For convenience use this order blank. Fill in columns below with quantity desired, stock number, description and price. You may send remittance with order (include enough for postage or parcel post shipment), or if you prefer SEND NO MONEY. Olson will ship C.O.D. and you may pay mail or expressman for merchandise and postage.

WE SHIP SAME DAY
WE GET YOUR ORDER

MONEY BACK GUARANTEE:
Everything you order from Olson is guaranteed as advertised. If you are not more than satisfied, you may return merchandise for cash refund.

Please Minimum Order $3.00

QUANTITY	STOCK NUMBER	DESCRIPTION	PRICE EACH	TOTAL
			TOTAL	
			ADD POSTAGE	
			TOTAL AMOUNT	

NAME _____

ADDRESS _____

CITY _____ ZONE ____ STATE ____

RN-852

OLSON RADIO WAREHOUSE • 275 E. Market St., Akron 8, Ohio

INDISPENSABLE!

PHOTOFACT BOOKS

Photofact Television Course. Covers TV principles, operation and practice. 216 pages; profusely illustrated; 8½ x 11". *Order* **TV-1**.....*Only* **$3.00**

Television Antennas. New 2nd edition. Describes all TV antenna types; tells how to select, install, solve troubles. Saves time; helps you earn more. 200 pages; illustrated. *Order* **TAG-1**.....*Only* **$2.00**

Television Tube Location Guide. Volume 2. Accurate diagrams show position and function of all tubes in hundreds of TV sets; helps you diagnose trouble without removing chassis. 224 pages; pocket-size. *Order* **TGL-2**. *Only* **$2.00**

Television Tube Location Guide. Vol. 1. Over 200 pages of TV receiver tube position diagrams on hundreds of models. *Order* **TGL-1**.....*Only* **$1.50**

Making Money in TV Servicing. Tested proved methods of operating a profitable TV service business. Covers all important phases. Authoritative, valuable guide to success. Over 130 pages. *Order* **MM-1**.....*Only* **$1.25**

Servicing TV in the Customer's Home. Shows how to diagnose trouble using capacitor probe and VTVM. Short-cut methods help save time, earn more on outside service calls. *Order* **TC-1**.....*Only* **$1.50**

1949-1950 Record Changer Manual. Vol. 3. Covers 44 models made in 1949, including multi-speed changers and wire and tape recorders. Original data based on actual analysis of equipment. 286 pages; 8½ x 11"; paper-bound. *Order* **CM-3**.....*Only* **$3.00**

1948-1949 Changer Manual. Vol 2. Covers 45 models made in 1948-49. Paper bound. *Order* **CM-2**. *Only* **$4.95**

1947-1948 Changer Manual. Vol. 1. Covers 40 post-war models up to 1948. *Order* **CM-1**.....*Only* **$3.95**

Recording & Reproduction of Sound. 2nd Edition. New, completely revised and vastly enlarged edition of the outstanding original volume. The most authoritative treatment of all phases of recording and amplification ever written. Over 800 pages. 6 x 9". *Order* **RR-2**. *Only* **$7.95**

Audio Amplifiers. Vol. 3. Clear, uniform, accurate data on 50 important audio amplifiers, plus full coverage of 22 FM and AM tuners, produced during 1950. 362 pages, 8½ x 11". *Order* **AA-3**.....*Only* **$3.95**

Audio Amplifiers. Vol. 2. A complete analysis of 104 well-known audio amplifiers and 12 tuners made 1949-50. 368 pages, 8½ x 11". *Order* **AA-2**.....*Only* **$3.95**

Audio Amplifiers. Vol. 1. 102 amplifiers and FM tuners made through 1948. 352 p. *Order* **AA-1**....*Only* **$3.95**

Auto Radio Manual. Complete service data on more than 100 post-war auto radio models. Covers over 24 mfrs. 350 pages, 8½ x 11". *Order* **AR-1**.....*Only* **$4.95**

Communications Receiver Manual. Complete analysis of 50 popular communications models. 246 pages, 8½ x 11". *Order* **CR-1**.....*Only* **$3.00**

Radio Receiver Tube Placement Guide. Accurate diagrams show where to replace each tube in 5500 radio models, covering 1938-1947 receivers. 192 pages, pocket-size. *Order* **TP-1**.....*Only* **$1.25**

Dial Cord Stringing Guide. Vol. 2. Covers receivers made from 1947 through 1949. Shows you the one *right* way to string a dial cord in thousands of models. Pocket-size. *Order* **DC-2**.....*Only* **$1.00**

Dial Cord Guide. Vol. 1. Covers sets produced 1938 through 1946. *Order* **DC-1**.....*Only* **$1.00**

Order from your Parts Jobber or write direct to
HOWARD W. SAMS & CO., INC., 2201 E. 46th St., Indianapolis 5, Indiana

HOWARD W. SAMS & CO., INC.

P. R. Mallory & Co., Inc. of Indianapolis 6, Ind.

The new publication contains complete cross-reference charts, specifications, and illustrated installation instructions for replacing car radio and other types of mobile communication equipment vibrators and their accessory buffer condensers, along with a list of the company's recommended replacements.

Listed are the original equipment receiver manufacturer and his model numbers with the numbers of the corresponding *Mallory* replacement vibrators. The capacity values of secondary buffers and the correct replacement units are also given.

Other cross-reference charts include vibrator types with their applications, original equipment vibrator numbers with correct replacements, and replacement vibrator numbers with correct replacements.

PICTURE TUBE DATA

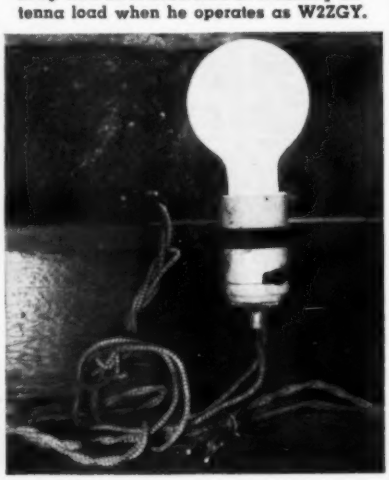
The Cathode-Ray Tube Division of *Allen B. Du Mont Laboratories, Inc.* has announced the availability of a new edition of its "Picture Tube Data Chart."

The chart, printed on heavy stock and suitable for wall mounting, lists the electrical and physical characteristics of any modern RTMA-registered TV picture tube.

Now in its fifth printing, the new chart has been especially designed for those concerned with television receiver design, research, and servicing.

Copies of the new chart are obtainable from the company's tube distributors. —30—

A multi-purpose test lamp finds many uses on Fred J. Lingel's test bench. A three-way bulb is mounted to the bench with a short piece of metal strap of the type used to hold packing crates together. The lamp may be used as an eye-level source of light for small work or for servicing in dark corners of the chassis. By connecting the lamp in series with the set or appliance to be repaired, the lamp can be used as a load check thus speeding the location of a fault. It can also be used as a continuity tester for transformer, motor, or heater windings. Mr. Lingel also uses the lamp with its twisted cord as a dummy antenna load when he operates as W2ZGY.



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Design Curves

(*Continued from page* 43)

formulas. The nearest available value of 68,000 ohms is suitable for R_3.

The only other value to be determined is that of condenser C. Reference to Fig. 6 shows that 3 db of boost is obtained at an abscissa value of approximately 1.0. We may now solve for C.

$$2\pi f\, CR_2 = 1.0$$

$$C = \frac{1}{2\pi f\, R_2} = \frac{1}{2\pi\ (500)\ (20{,}000)}$$

$$C = 1.59\text{x}10^{-8} = 0.0159 \text{ microfarad}$$

A suitable value is 0.015 microfarads. We note from the curves that for this example the boost at 50 cycles can be about 14 db. Fig 4 shows these values placed in the circuit.

It may be of interest to determine the gain of the circuit including the tone control. The "Resistance-Coupled Amplifier Chart" shows a gain of 45 to the plate of the 12AX7. Subsequent to the tube gain of 45 our circuit has a voltage divider formed by R_3 and R_2 which attenuates the voltage by a factor $(R_2+R_3)/R_2$, or 4.4. The over-all voltage gain, therefore, is about 10. This value of gain corresponds to the zero db reference level used in the curves.

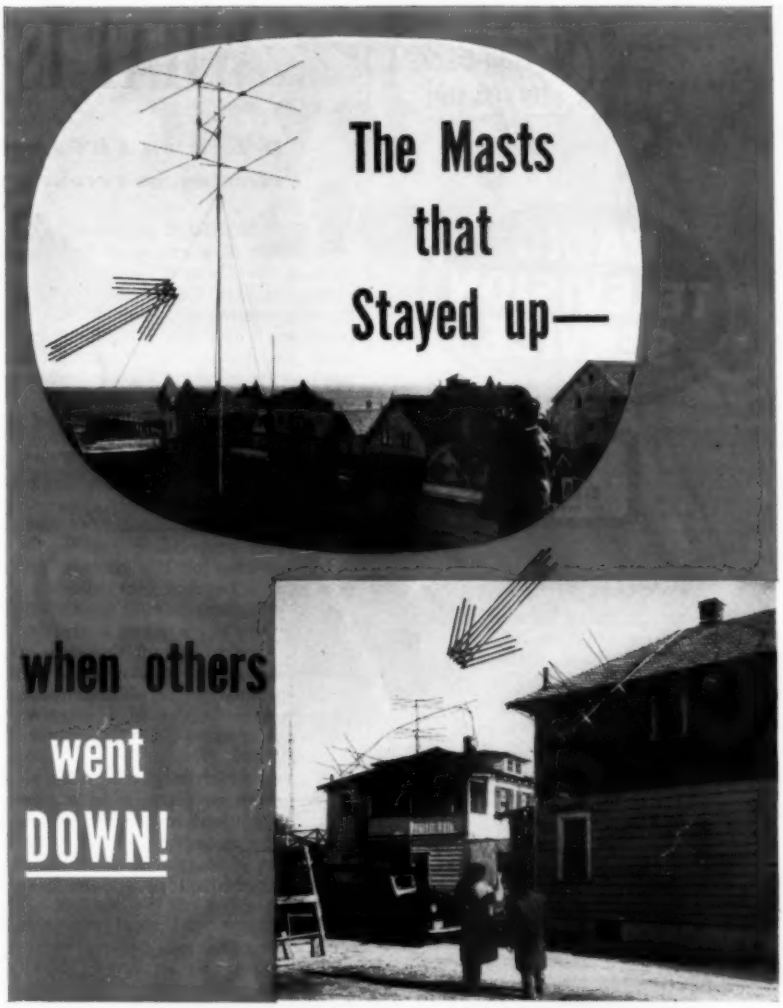
Bass-Attenuating Circuit

A circuit designed to accomplish variable bass attenuation is shown in Fig. 7. This design requires that the equivalent source impedance of the tube V_1 be small compared to R_2. In order to be practical we have assumed some source impedance in the equivalent circuit of Fig. 8 which was used for analysis.

Because the use of this circuit does not cause any loss of gain, only one sheet of design curves was considered necessary; there is no harm in designing for more attenuation than may be required. The curves of Fig. 10 were computed with the ratio R_1/R_2 equal to 0.1 and R/R_2 equal to 10. The curves are also substantially accurate if the ratio of R_1/R_2 is less than 0.1. It may be noted that this circuit gives a small amount of bass boost, the specific amount depending upon the value of R_1. This circuit is actually a special case of a circuit to be described in the next article which will give either bass boost or bass attenuation with a single control.

The method of applying the curves to a design problem should be apparent from a review of previous examples. We can think of no particular pitfalls which might be encountered in the use of this circuit. The only advice which seems appropriate is that a medium-mu triode is usually the best choice for V_1 in order to satisfy the requirement for a small source impedance (R_1) to the tone control.

(*To be continued*)



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WHAT IS EIDOPHOR?

Details on CBS's color system for theater TV viewing, as recently unveiled in New York City.

THE EIDOPHOR projector, a development of a group of Swiss scientists at the Federal Institute of Technology and Dr. Edgar Gretener A.G. of Zurich, is similar to a motion picture projector. The arc lamps are practically identical and projection lenses are used to magnify the desired images on the theater screen.

Through the joint efforts of this Swiss group, *CBS*, and the technical staff of *Twentieth Century-Fox Film Corporation*, the original black-and-white equipment has been converted in order to provide color transmissions for theater projection.

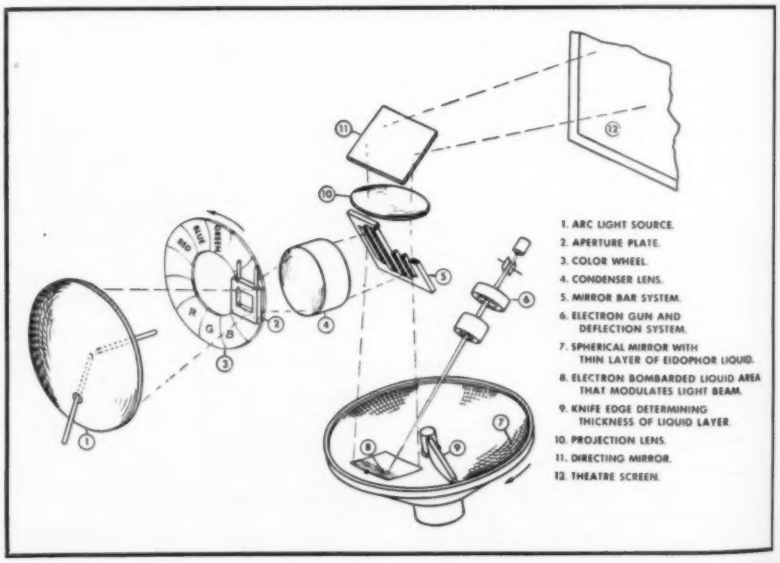
In the case of the motion picture projector, a band of film carrying a series of images is passed intermittently through the light beam, a shutter being provided to cut off the light while the film is traveling. In the *Eidophor* projector, instead of photographic images on a strip of film, a sequence of images is created on a thin layer of a special liquid (about the consistency of honey) which is placed on a slowly rotating mirror surface in a position optically equivalent to the position of the film in an ordinary projector. The succession of images on the thin liquid layer is produced by means of electrons deposited on the surface of the liquid. These electrical charges are proportional to, and controlled by, the television signal, in much the same manner that a television signal is used to produce an image on a regular TV picture tube.

The essential difference is, of course, that in the home receiver tube the electron beam strikes the end of the tube and causes the phosphor material to glow point-by-point and line-by-line, with a brightness which is proportional to the point-to-point brightness of the original scene.

In the *Eidophor* projector, however, the electron gun causes the liquid to take on tiny surface irregularities and thus to change its optical properties. The picture thus produced appears very much like the relief image in hardened gelatin used in some photographic processes, after the silver image has been bleached away. By means of auxiliary lenses and properly arranged mirrors the instantaneous picture on this "image bearing" layer of liquid is projected to the screen.

The *Eidophor* image is in a position "optically equivalent" to the position of the film in a standard projector. This point should be explained further. In the motion picture projector the center line or the light beam passes through the center of the picture being projected and along the same line through the center of the lens to the center of the screen. In the *Eidophor* system, however, the light from the arc passes through auxiliary lenses to a plane mirror arranged in parallel bars—and set at about 45 degrees to the light beam direction—which reflect half the light downward. (Half of the light because the width of the mirror bars and the spaces between them are substantially equal). Thus half the light is lost, just as it is lost by the shutter blades in the standard motion picture projector. The light

Mechanical layout of the Swiss-inspired "Eidophor" theater projection system.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4. CONDENSER LENS.
5. MIRROR BAR SYSTEM.
6. ELECTRON GUN AND DEFLECTION SYSTEM.
7. SPHERICAL MIRROR WITH THIN LAYER OF EIDOPHOR LIQUID.
8. ELECTRON BOMBARDED LIQUID AREA THAT MODULATES LIGHT BEAM.
9. KNIFE EDGE DETERMINING THICKNESS OF LIQUID LAYER.
10. PROJECTION LENS.
11. DIRECTING MIRROR.
12. THEATRE SCREEN.

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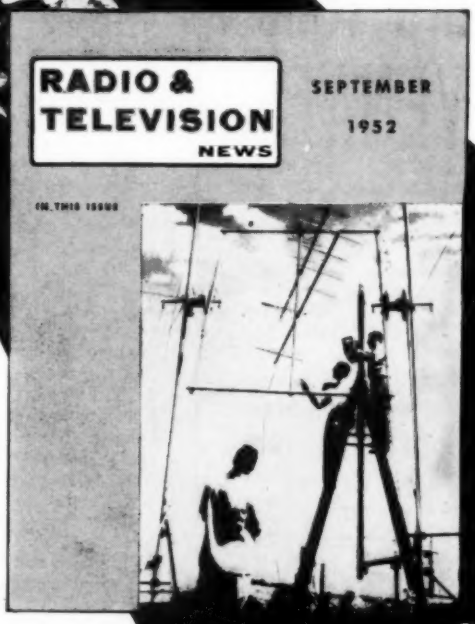

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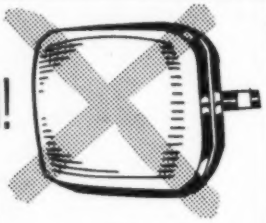

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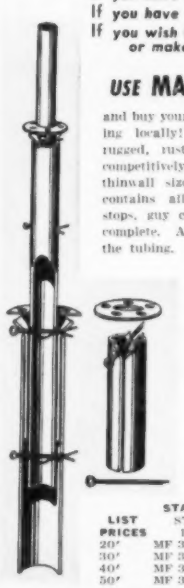

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that travels downward strikes the *Eidophor* liquid film and the reflecting mirror surface on which the film is carried.

This mirror reflects the light straight back along the same path *providing there is no picture* (or distortion) on the liquid surface. When there is no such picture, the reflected light strikes the tilted mirror bars and is again reflected back to the lamp house, not to the screen. Hence there is no light on the screen when there is no picture on the liquid. However, when a picture is formed on the liquid, as previously described, the optical properties of the liquid layer are changed and the light reflected by the *Eidophor* mirror is deflected, enabling it to pass through the slots between the tilted bars. The picture forming light passes through the objective lens and then strikes a final mirror which directs it to the projection screen.

Since the amount of the deflection of the light from each point-to-point area of the *Eidophor* picture depends on the amount of deformation of the liquid at that picture point and since each picture point is "scanned" by the electron beam many times a second, a complete picture reaches the screen. The pictures seem to have action just as do motion pictures or home TV pictures because the component images follow each other in such rapid succession that the human eye cannot see the pictures separately.

What about color with this new projection system? Motion pictures can be made in color if three separate films are used—one colored in a manner to produce a red light yielding a stimulus equivalent to the red stimulus received by the eye when it views the scene; one colored green in a similar way; and one similarly colored blue. If these three partial color pictures are projected together a complete picture in natural color will result.

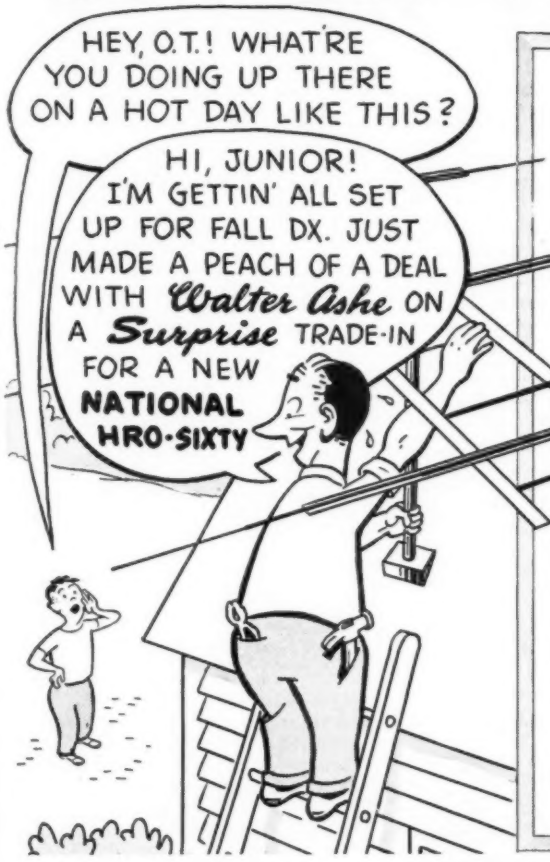
These three separate color records may be projected at the same instant but they could be equally well projected one after the other at a sufficiently rapid rate so that the eye does not see the colored images as separate and distinct single color pictures.

This latter system is roughly the field sequential system of *CBS'* home color television. Approximately this same basic technique is being used for color projections with the *Eidophor* system. A small wheel, composed of red, green, and blue segments, is inserted in the beam of light at the arc lamp of the projector and is rotated so that the red, green, and blue segments are placed in position in the beam at the instant that the television signal contains picture information of the corresponding color.

This new system, the one which *Twentieth Century-Fox Film Corporation* proposes to offer to the motion picture theater owner, was recently demonstrated to the press in New York City. See this month's "For The Record," page 8.

—30—

GET ON THE BEAM..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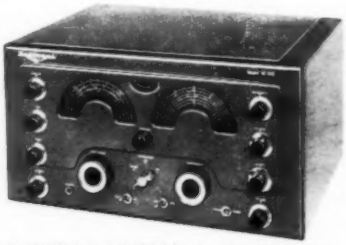

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REEL REVIEW

THIS MONTH we received five tapes for review purposes, four in the *A-V Tape Libraries'* "Concert Hall" series and one of their "popular" programs. As noted in the individual reviews, this group of selections ranged from good to mediocre and from interesting to trite.

* * *

Tapes of the Month

A-V #104 (MUSICAL VARIETIES)
I'm in the Mood for Love—Music Maestro Please—El Carinoso—You're So Understanding—A Fellow Needs A Girl—Norwegian Dance (Grieg)—Anniversary Song—I'm Glad I Waited for You—Exactly Like You—Caminito — El Rancho Grande — Girl of My Dreams.
(Available in 7.5" single-track; 7.5" double-track; or 3.75" double-track)

According to the *A-V* people, this reel is quite popular both here and in Central and South America where distribution of the *A-V* catalogue has been arranged. As for the type of music, it is the sort one hears over the "wired music" in the cocktail lounges. If you like that music, you'll really enjoy this one. As for the quality—technically speaking—adequate. When played on an *Ampex*, one hears a somewhat restricted range, as though dubbed from a disc. Played on the home-type of machine, such as a *Pentron* or *Revere*, this reel compares with the best.

A-V #1017 (CONCERT HALL)
Part 1. Sonata in E Major, Op. 109 (Beethoven), Sonata in A Flat Major, Op. 110 (Beethoven)
Jorg Demus, pianist
Part 2. Sonata in A Flat Major, Opus 110 (Concluded), Fantasy Impromptu (Chopin), Polonaise in E Flat (Chopin), Scherzo in C Sharp Minor (Chopin)
Alexander Jenner, pianist
(Available in 7.5" single-track; 7.5" double-track; or 3.75" double-track)

Beethoven Sonatas and Chopin Etudes, surprisingly enough, do go well together. One must admire *A-V*'s courage in releasing an hour's program of piano-on-tape. This type of recording always becomes the pot-shot target for audio engineers, music lovers, high fidelity enthusiasts, and "super-ears" who cock their heads, appear to strain their innermost critical senses for telltale wow, flutter, and other dead giveaways that make the piano "one of the most difficult instruments to record." Perhaps it is *A-V*'s tape duplication set-up, perhaps it is just luck in this recording, but we enjoyed listening to this reel on the *Ampex* which was loaned to us for this purpose.

A-V #1018 (CONCERT HALL)
Part 1. Legend of the Fair Melusine (Mendelssohn), Symphony No. 1 in C Minor, Op. 68 (Brahms)
Austrian State Symphony
Part 2. Symphony No. 1 in C Minor, Op. 68 (Concluded), Zur Namensfeier, Op. 115 (Beethoven)
Austrian State Symphony
(Available in 7.5" single-track; 7.5" double-track; or 3.75" double-track)

Mendelssohn, Brahms, and Beethoven comprise some sort of musical jackpot when on the same program, provided the selections on the program contain music contrast for emotional exercise and are sincerely performed. This critic suspects that the engineer performing the "balance" on the Mendelssohn work did not do the job on the Brahms. The Mendelssohn is good. However, there is too much "presence" in the Brahms recording, sounding as though the microphones were too close to certain of the instruments, not giving it the feeling of an over-all orchestral pick-up, favoring specific instruments. This does not make for the best listening and actually makes it difficult to judge the over-all performance of the work.

A-V #1019 (CONCERT HALL)
Part 1. Pictures at an Exhibition (Moussorgsky)
Sari Biro, pianist
Part 2. Caucasian Sketches, Op. 10 (Ippolitov-Ivanoff)
Austrian State Symphony
Romanze Andaluza (Sarasate)
Ivry Gitlis, violinist and Heinrich Berg, pianist
(Available in 7.5" single-track; 7.5" double-track; or 3.75" double-track)

With this reel, *A-V* steps out into a field in which the big-name labels are competing with one another. The Spanish-speaking peoples would describe such music as "musica typica," indicating folk music or music whose character and measure can be associated with geographic areas and peoples. Although the top labels are competing on that level, no one is getting hurt and everyone is having some success. So, young *A-V* puts its "two cents" in with an excellent reel. This reel is good in all respects.

A-V #1020 (CONCERT HALL)
Part 1. Eine Kleine Nachtmusik (Mozart)
Salzburg Mozarteum Orchestra
Concerto #24, for Piano and Orchestra in C Minor, K491 (Mozart)
Austrian State Symphony, Wilhelm Loibner, conductor, Sari Biro, pianist
Part 2. Concerto #24 for Piano and Orchestra in C Minor (Concluded), King Thamos Overture (Mozart)
(Available in 7.5" single-track; 7.5" double-track; or 3.75" double-track)

Here is a Mozart festival to satiate the senses with the emotional, proud, and whimsical aspects of that music genius of the past, present, and future. The Salzburg Mozarteum Orchestra gives a most charming rendition of the frothy Eine Kleine Nachtmusik. The engineering is excellent with respect to pick-up and auditorium acoustics. The Concerto #24 (beginning on Part 1 and concluded on Part 2) suffers by comparison. The acoustics on this selection are, in our estimation, not too good.

—30—

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1A5GT	.65	5V4G	.87	6BC7	.79	6L6GA		6X5GT		12A7	1.15	14A7	.89	47	
1A7	.59	5W4	49c	6BD5GT	.89	6L7	.69	6Y6G	.69	12A8	.59	14AF7	.93	50A5	.89
1B3GT	.69	5W4GT		6BE6	.49	6N6G	1.40	7A4	.59	12AH7	1.45	14B6	89c	50B5	59c
1B5	29c	5X4G	.65	6BF5	.59	6N7GT	69c	7A5	.89	12AT6	.49	14B8		50C5	
1C7G		5Y3GT	.45	6BF6	.59	6P5GT		7A6	73c	12AT7	.89	14C5	1.07	50C6G	1.04
1E7		5Y4G	.54	6BG6G	1.49	6Q7GT	.49	7A7		12AU6	.59	14C7	.98	50L6	.49
1H5GT	.49	5X4G	81c	6BH6	59c	6R7GT	.69	7A8		12AU7	.65	14F7	.89	50X6	.79
1J5GT	.69	5Z3		6BJ6		6S4	.49	7B4		12AV6	.49	14F8	1.30	50Y6	.59
1L4	.59	6A3	1.15	6BL7	.79	6S7GT	1.15	7B5	.73	12AV7	.89	19BG6G	1.49	70L7	.89
1LA4	1.19	6A7	1.21	6BN6	.89	6S8GT	.69	7B6	.73	12AW6	.95	19T8	.89	71A	.87
1LA6		6A8GT	.59	6BQ6GT	.85	6SA7GT	.59	7B7	73	12AX7	.69	20	1.40	75	59c
1LC5	.69	6AB7	1.15	6BQ7	1.49	6SC7	.59	7B8	.73	12BA6	.49	24A	.59	77	
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1LE5	1.19	6AG5	.69	6C6		6SF5GT	.49	7C6		12BF6		25L6GT	.49	83	1.45
1LH4	1.19	6AG7	.89	6C8G	1.15	6SH7	.59	7C7		12BH7	.69	25W4GT	.59	85	.79
1LN5	1.19	6AH6	1.40	6CB6	.59	6SH7GT	.59	7E6	.59	12C8	1.15	25X5	1.04	117L7	1.40
1N5GT	.59	6AK5	.89	6CD6G	1.49	6SJ7	49c	7E7	.69	12F5GT	65c	25Z6GT	.59	117N7	.89
1P5GT	69c	6AK6	1.08	6D6	.59	6SJ7GT		7F7	.89	12H6		32L7GT	1.15	117P7	1.40
1Q5GT		6AL5	59c	6D8G	1.15	6SK7GT	.59	7F8	1.47	12J5GT	.54	35A5	.99	117Z3	.49
1R5	59c	6AQ5		6E5	.59	6SL7GT	.69	7G7	.69	12K7GT	.59	35B5	59c	117Z6	.69
1S5		6AQ6	.81	6F5GT	49c	6SN7GT	.59	7H7	.59	12Q7GT	.49	35C5		807	1.55
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1X2A	.69	6AU5GT	.69	6H6GT	.49	6SS7	.72	7N7	59c	12SF7		35Z3		1619	.45
2A3	1.15	6AU6	49c	6J5GT	.49	6T7G	1.15	7Q7		12SH7GT	.59	35Z4	.49	1629	.29
2A5	.79	6AV6		6J6	1.04	6T8	.89	7R7	.89	16SJ7GT	.49	35Z5	.45	2050	2.00
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3Q4	.59	6B5		6J8G	1.15	6U6GT	59c	7V7	.69	12SL7GT	.69	35/51	.79	7193	.87
3Q5GT	1.08	6B6G	.79	6K5GT	.69	6U7G		7W7	1.07	12SN7GT	.99	41	.72	VT51	29c
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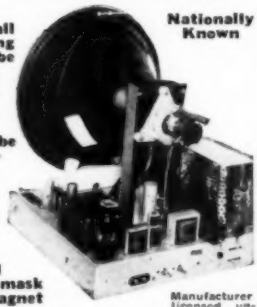

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The "Dialaudio" System

(*Continued from page* 63)

the system will amplify its hum pickup.

R and *C* (Fig. 1) are used in a spark suppression circuit. The inclusion of these components is a "must" in order to prevent premature pitting and, in fact, destruction of the interrupter and dial contacts. The values shown in the circuit in Fig. 1 will hold true for a system identical to the one described. For other coil voltages and other power supplies different combinations of *RC* should be used.

As will be noted in the over-all view, the step-switch, relay, rotary switch, and various input and output connections were all mounted in a compact 4" x 5" x 6" cabinet. Solid hookup wire was used so that there would be a minimum number of wires located away from the chassis, wires which would tend to clutter up the inside of the box and make circuit tracing difficult. Insulated shielded wire was used for the audio circuits to prevent hum pickup in the high impedance lines. These wires are grounded to the audio ground. The power supply ground was kept separate to avoid any possibility of shock.

The system described is presented as a guide as it is felt that the individual technician will be able to design an installation suited to his own needs.

REFERENCE

Bulletin §73, Automatic Electric Co., 1033 West Van Buren St., Chicago 7, Ill.

—30—

SAVE METER FACES

By ARTHUR TRAUFFER

WHEN making a volt-ohm-milliammeter using an 0-1 milliammeter or a microammeter as a foundation unit, it is common practice to cement the new paper scale directly onto the original scale on the meter.

A better plan is to remove the two small screws and turn the scale plate upside down and then cement the new scale onto the back of the plate. Thus, if you ever want to remove the meter to sell it or trade it, all you have to do is flop the plate over again and the original scale is brand new!

The photo shows an 0-1 d.c. milliammeter opened up. The original scale plate, with its back facing the camera, is standing against the meter case. The v.o.m. paper scale is lying flat in the foreground. —30—

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What's New in Radio

(*Continued from page 78*)

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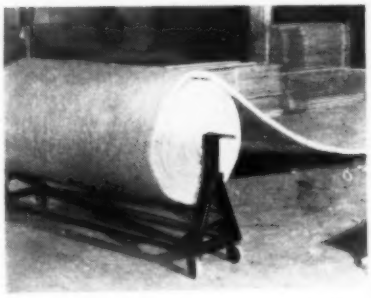

variety of audio system installations including studio insulation and cabinet deadening.

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19" Metal or Glass (any type)	23.95	28.95
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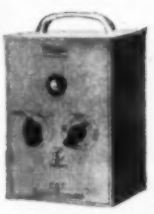

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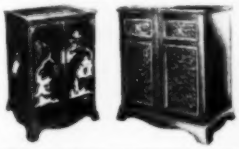

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A catalogue covering the new "Stabelex D" units is now available from the company on request.

CAPACITY BRIDGE

Simpson Electric Co., 5200 W. Kinzie, Chicago, Ill., has developed an improved version of its Model 381 capacity bridge which makes it more compact and easier to use.

A button is pressed for the desired range, the bridge arm is adjusted for maximum meter deflection, and the capacity is read on the scale.

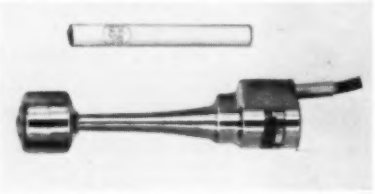
Ideally suited for radio and TV service work, the new Model 381 is housed in a bakelite case with etched aluminum panel.

Further information on this bridge will be supplied by the company.

NEW CRYSTAL MIKE

The Turner Company, Cedar Rapids, Iowa, is now in production on a new crystal microphone which features extremely compact construction.

Although not much larger than a cigarette, the frequency response is 80



to 7000 cps with a sensitivity of approximately 58 db below 1 volt/dyne/sq. cm.

Additional details on the Model 80 microphone are available from the company on request.

SINGLE-PHONE HEADSET

Airphone Co., Suite 309, Calument Building, Miami, Florida, is now offering a new CAA-approved single-phone type headset to the trade.

The new "Airphone" consists of a specially designed miniature earphone similar to those used in hearing aids, but more rugged in design. The ear-

phone is attached to a supporting, individually-fitted earpiece by means of a snap fastener. Component parts include a personal volume control with lapel clip, two double-twisted vinyl covered cords, and a PL-55 plug.

The complete assembly weighs only 2½ ounces but is said to be 12 times more sensitive than conventional headphones.

—30—

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SIGNAL TRACER SPECIALISTS

Spot Radio News

(*Continued from page* 18)

that the . . . "welfare of the people and not the happiness of the FCC is at stake in this situation. . . . Every applicant is entitled to his day in court without years of delay and it cannot be given to him unless we provide the money to hire the minimum of examiner teams." According to the Senators, the appropriation of $800,000 can . . . "set in motion a chain reaction which in two years' time will create $3-billion in business . . . figures which are ultra-conservative."

"We ought not to shirk our duty," members of the committee declared. "We ought to appropriate the money to authorize the recruiting of the 20 examiner teams or frankly tell the people that because money is not available for processing their television applications, they must wait 6 to 10 years for TV in many areas of the United States."

DOLLARS REQUIRED for the examiners and other members of the Commission was also the subject of a fighting talk by Commissioner Ed Webster, before the Indiana Broadcasters Association.

Noting that often many have asked why the Commission with over a thousand employees should have any difficulty disposing of the matters that come before it, Webster declared that the average person has no conception of the innumerable duties and responsibilities of the Commission and its staff. Explaining the structure of the Commission's staff, the Commissioner said that of the 1115 persons employed, 393 are located in field offices throughout the country. There are 722 employees sparsely scattered throughout Washington, with 35 assigned to the Commissioner's offices, 16 to the general counsel's office, 22 to the chief accountant's office, 77 to the chief engineer, 59 to the field engineering and monitoring bureau, 127 to administration, 7 to the opinion and review section, 32 to the secretary's office, 20 to interdepartmental activities, 110 to the safety and special radio services bureau, 84 to the common carrier bureau and 121 to the broadcast bureau. In addition, there are a dozen clerical assistants in various offices. Of the 121 in the broadcast bureau, only 61 are professionals: 27 engineers, 22 lawyers, and 12 accountants. It is to this group that the problems of modifications, license renewals, assignments, and transfers are relayed. And, declared Webster, only thirteen members of this staff, or 6 engineers, 2 lawyers, 2 accountants and 3 secretaries, are in the television division, which is expected to handle the forthcoming avalanche of applications for new stations.

Describing the processing problems that are expected, on the basis of prior experience, the Commissioner said that

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. . . complete with tubes, MN28C control box, loop transmission cable, MN20E loop, flexible cables, plugs, etc..... **$67.50**

SCR 625 Famous Mine Detector
For Prospectors, Miners, Oil Companies, Plumbers, etc.
This unit is being offered now at a considerable reduction in price. Recently advertised at $79.50 it is now available in the same brand new wrappings in suitcase style carrying case (less batteries) at
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BC-733-D LOCALIZED RECEIVER. Complete with tubes and crystals.
DM-33-A DYNAMOTOR for above.
FT-293 MOUNT for 733
BC-732 CONTROL BOX for 733.
PLUGS for 733.
ARN-7 AUTOMATIC DIRECTION FINDER. Complete installation.
SCR-269-G AUTOMATIC DIRECTION FINDER. Complete installation.
SCR-522 VHF TRANSMITTER & RECEIVER. Available as complete installation or just transceiver.
R89/ARN-5 GLIDE PATH RECEIVER.
R57 GLIDE PATH RECEIVER.
BC-638-A FREQUENCY METER.
BC-376-H TEST OSCILLATOR.
ID6/APN-4 LORAN INDICATOR.
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RT34/APS-13 TRAIL-WARNING TRANSCEIVER. 420 MC.

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		Used	New
BC-442	ANTENNA RELAY. Less cond. with cond.	$ 1.95	$ 3.95
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MC-215	MECHANICAL DRIVE SHAFT. Per length		2.95
BC-456	2-POSITION RECEIVER CONTROL BOX		2.95
BC-459	Less tubes	12.95	
BC-455	6-9 MC RECEIVER. With tubes	9.95	14.95
	Less tubes	7.95	
BC-453	With tubes	$19.95	
	Less tubes	14.95	
MC-211	90° ANGLE COUPLING UNIT.		$0.98
FT-234	MOUNTING RACK for single transmitter	2.95	3.95
FT-226	MOUNTING RACK for 2 Command Xmtrs.		3.95
FT-221	MOUNTING PLATE for **FT-220**		1.50
FT-220	MOUNTING RACK for 3 receivers		2.25
FT-225	MOUNTING PLATE for **BC-456**		2.25
BC-456	MODULATOR. For **SCR-274**..		4.50

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BC-457 (4-5.3 MC) and **BC-458** (5-3.7 MC). Command transmitters. Shipment just in. Limited Quantity. Less tubes and xtals. Good cond. EACH .....$4.95 PER SET..... 9.50

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MOTOR
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140-144 MC. Complete with control box, tubes, 12/24 VDC dynamotor. This is a special reduction for this month only.
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TU-6—TUNING UNIT. (3-4.5 MC) for BC-375 and BC-191. **Used**..... 2.95
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SCP1	4.50	5BP1	4.95	16JP4	$19.95
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TU-17—TUNING UNIT (2-3 MC.) for BC-223 Transmitter. **Used**..... 2.95
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I-70—"S" TUNING METER. **New, $2.50. IN-4A**—L/R TUNING METER. **Used**..... 3.95
FL-8—RANGE FILTER..... $1.95 **FL-5**—RANGE FILTER..... 1.25
WOBULATOR: See Page 43, Dec., '51 RADIO NEWS..... 5.95
BC-709—INTERPHONE AMPLIFIER. Battery operated, light wt. Complete with tubes, shock mount and Instruction Manual. **New**..... 3.95
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10 mfd	2000 vdc	C-D TJU-20100		6.95
2 mfd	2500 vdc	Industrial 25SAU200		3.39
4 mfd	2500 vdc	Aerovox 2509		5.95
10 mfd	2500 vdc	C-D TJU-25100A		7.95
1 mfd	3000 vdc	C-D TJU-30010		3.50
0.1 mfd	4000 vdc	C-D TJU-40001		2.50
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Here's a neat and compact surplus item which converts very simply to 3700-3730 KC crystal controlled. Condition? Guaranteed suitable. Instructions? Yes, we furnish them! Complete, comprehensive, step-by-step; nothing left to guesswork. This is 5.3-7, the command transmitter which has been such a favorite with old-timers. By the time this ad appears, the BC-457, described in November QST, will be all gone, so we worked out the conversion on 5.3-7. It had to be converted anyway, so why not convert the lower priced and available unit? Just as easy. Now don't wait until these are all gone! **ONLY** **$7.95**

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(See Dec. Radio & TV News)

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CHAMOIS HEADSET PADS. Clean, in glassine bag. They're a real pleasure to wear..... Pr. $1.50

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MN-26-C Remote Controlled navigational direction finder and communications receiver. Manual DF in any one of three freq. bands, 150 to 1500 KC. 24 V. Self contained dynamotor supply. Complete installation, including receiver, control box, loop, azimuth control, Left-Right indicator, plugs, loop transmission line, and flex. shafts.
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undoubtedly, hearings on at least 500 applications will be obtained soon after summer has set in. With the present staff of seven examiners, it might be possible to take care of 84 cases a year, it was noted. But, he said, there's more to it than this, for hearings must be held on matters involving services other than broadcast. As a matter of fact, he noted, there are now two common carrier matters designated for hearings which may take six months from the beginning to the issuance of initial decisions by each of the two examiners designated to hear the cases, leaving five examiners for TV and all other hearings. In view of this, Webster felt that it would not surprise him if no more than 60 to 70 TV application hearings would be conducted within the next year.

It is sincerely hoped that everyone will realize the seriousness of the Commission's plight and funds will become available immediately to hire the urgently needed legal staff.

TRANSIT RADIO, providing for the pickup of programs in buses or streetcars, which has been subjected to some rough treatment in the courts, finally won its freedom, and from the highest bench in the land. In a 7-to-1 vote, the Supreme Court declared that it is perfectly legal to broadcast news, music, and commercials to vehicles, and it is not an invasion of privacy as cited by the Circuit Court of Appeals a year ago.

According to Associate Justice Harold H. Burton, this form of broadcasting does not violate the First and Fifth Amendments to the Constitution, which guarantee freedom of speech and protection against taking away liberty or property without due process of law. In his decision, Justice Burton wrote that however complete the passenger's privacy . . . "may be at home, it is substantially limited by the rights of others when its possessor travels on a public thoroughfare or rides in a public conveyance."

Associate Justice William O. Douglas, writing the lone dissent, declared that outside the house, one . . . "has immunities from controls bearing on his privacy." In his opinion . . . "if liberty is to flourish, government should never be allowed to force people to listen to any radio program." He felt that forcing people to listen to the ideas of others created a powerful propaganda weapon. "Today it is a business enterprise working out a radio program under the auspices of government," the Justice continued, "and tomorrow, it may be a dominant political or religious group. . . . Once privacy is invaded, privacy is gone. . . . Once a man is forced to submit to one type of radio program, he can be forced to submit to another. . . . It may be but a short step from a cultural program to a political program."

The decision, won by WWDC-FM in Washington, created quite a flurry of activity along transit-radio row, with temporary plans for expansion announced by several operators. No definite programs can be set up until the FCC decides whether the present rules permit the use of a beep signal for switching talk programming. It is expected that a general rule-making hearing on the subject will be held soon so that industry will be able to plan accordingly.

Before the courts called transit-radio illegal last year, about a dozen cities featured a transit-radio service: St. Louis, Cincinnati, Houston, Washington, Worcester, Tacoma (Wash.), Evansville (Ind.), Wilkes-Barre (Penna.), suburban Pittsburgh, Allentown (Penna.), Huntington (W.Va.), Des Moines (Ia.), Topeka (Kan.), and suburban Washington.

Before transit-radio was introduced in many communities, assorted surveys were made to determine its virtues. In St. Louis, a study made by a newspaper and a university indicated that nearly 75% favored radio in buses and trolley cars. Commenting on the survey in an editorial, the *Post-Dispatch* said that the poll revealed some interesting results: "Young people are overwhelmingly for music on the streetcars. Nearly 93% of them favor it. Older people, those 50 years of age and more, are less enthusiastic. That the objectors object, there can be no doubt. . . . At this point, the 'ayes' seem to have it."

THEATER TV, whose future has been questioned by many because of the repeated hearing delays, will now have to wait until next year, or specifically January 12, 1953, before its place in the sun can be determined. Originally delayed by the pressure of allocation business and other acute communication problems, a shortage of manpower has now been cited as the reason for postponement.

DESPITE A CONSIDERABLE tendency toward more extensive use of very-high frequencies for voice communications between aircraft and ground, high-frequencies will continue to be used in many parts of the world for the forseeable future. Thus reported Edgar A. Post, superintendent of navigational aids for the *United Air Lines*, in an interview on a symposium on internationl air transportation conducted in Copenhagen recently, during which communications and electronics experts of 20 airlines, 30 manufacturers, and 6 other international organizations and agencies, plus the civil aviation departments of 7 states and the military air forces of 3, participated.

One of the interesting technical subjects discussed at the meeting was the possible operational advantage of single-sideband over double-sideband transmission on the high frequencies. It was pointed out that the *ssb* system consists basically of transmission of messages on a carrier tone and one sideband, rather than with the two sidebands which is customary. A form of *ssb* using a voice-suppressed carrier

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system is now under experimental test in Britain and has been reported to have exhibited five advantages: A large improvement of 9 db in signal strength; better intelligibility in the face of interference; almost complete absence of distortion due to selective fading; a halving of the probability of jamming by a single strong interference signal within the broadcast band; and the ability to pack more channels into a given frequency space. The disadvantages of *ssb*, revealed thus far, lie in the necessity for accurate crystal control, using a close synchronizing tolerance of ± 300 cycles, as a matter of course, and the increasing complexity of the receiver due to the need for automatic-frequency control.

Airborne equipment using *ssb*, it was said, would be generally equal in weight and bulk to the *dsb* type, and create a lighter drain on the power supply, but would require a more complicated transmitter and receiver circuit. It was also disclosed that the *ssb* receiver used on the ground will accommodate *dsb* reception as well, without any alteration, but with some loss.

French technicians at the meeting suggested that a slight variation of the basic *ssb*, using an unsuppressed carrier, would eliminate some of the troubles stemming from the need for very stable crystal-controlled radio carriers. While this would sacrifice a substantial amount of the theoretical advantage of *ssb*, it was said to be more adaptable to airline use.

INDUSTRY'S striking contribution to the critical material stockpile received a stirring tribute from Donald S. Parris, deputy director of the electronics division of NPA, during a meeting of management personnel at the recent Parts Show in Chicago. Complimenting industry on their conservation plans, voluntarily put into effect to save critical metals, Parris said that substantial quantities of copper and nickel were saved through ingenious production and design techniques. Without such self-imposed programs, both the civilian and military fronts would have been seriously affected, Parris declared. The component and accessory makers deserve a round of applause for their enviable efforts, he added. . . . . L.W.

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International Short-Wave

(*Continued from page 65*)

Colombia—HJCX, 6.018, noted Sundays to after 0200 at excellent level. (N. Z. DX Times)

Curacao—Willemstad, 5.014A, noted with *English* program on Wednesdays 2000-2030. (Kolberson, N. J.)

Czechoslovakia—Prague, 9.55, noted with *English* for North America 1930-2000; fair. (Boggs, Mo., others)

Denmark—By this time, Copenhagen should have a *new* program on the air for Greenland daily 1900-2000 on OZF, 9.520, with the program for South America changed to 1730-1830 on Mon., Wed., Fri., on same channel. (WRH) Is now scheduled to Australia, New Zealand over 15.180 on Tue., Thur., Sat. 0400-0500; to India, Burma, Malaya, Indonesia on Tue., Thur., Sat. at 0900-1000; broadcasts are followed by a 20-minute program for Danish seamen in areas to which the transmissions are directed. (Radio Australia)

Dominican Republic—HI2A, 9.680, Ciudad Trujillo, is noted in Sweden at fine level from around 1855. (Engberg) HI2T, 9.735, noted recently with *English* talk 2100-2110. (Kary, Pa.) Is parallel on HI4T, 5.970.

Dutch New Guinea—A station heard on 7.126 signing off around 0700 is believed to be *Radio Hollandia*. (Stark, Texas)

Egypt—The Chief Engineer of *Radio Cairo*, 9.715, states that schedule remains 1345-1700. (Bellington, N. Y.) Noted with news in French after 1345 sign-on. (Pearce, England) Has news in *English* 1400.

Ethiopia—Radio Addis Ababa, 15.047A, noted 1230-1245 with native music and singing; faded severely around 1250. (Cox, Dela.) Reported to sign off now around 1306. (Pearce, England, others)

France—Current schedule for the Overseas Service in French from Paris includes 1830-2000, 9.685, 11.700 to Antilles, Guiana; 2230-2245, 7.105 to Madagascar, Reunion, Fr. Somaliland; 0030-0130, 9.550, 17.850, to Tahiti, Pacific; 0145-0230 to Fr. East and Fr. West Africa and 0230-0300 to New Caledonia, New Hebrides, 15.240, 17.850; 0530-0600, 17.850, to Antilles, Guiana; 0800-1000, 15.400, 15.350, 17.850, to Indo-China; 1500-1600, 9.540, 11.700, 15.240, to Fr. East and Fr. West Africa; 1730-1800, 9.675, 11.920, to Indo-

USE YOUR GDO FOR ALIGNMENT

By LEWIS S. HUGHES

THE grid dip oscillator is well-known to most hams but very few service technicians are aware of its usefulness around the shop. It can be used as a marker generator for TV and FM alignment, for setting traps in television sets, and, believe it or not, for checking condensers in a set while the set is turned on—without unsoldering one side of the condenser. It's wonderful for catching that intermittent condenser that heals itself the minute you touch a test prod to it.

To use the GDO as a marker generator, set the grid dipper near the receiver being aligned and tune it to the desired marker frequency. You may have to move it around a bit to get just the right amount of coupling you need to keep the pip as small as possible. If the pip is too large, it will change the shape of the curve. Use the grid dipper and marker generator to get two pips on the curve. In this way you will not have to keep running the marker generator back and forth to check the other side of the curve.

For setting traps, the GDO is not as accurate as the sweep generator and scope, but it serves the purpose by permitting the touching up of the traps in the field. Set the grid dipper at the trap frequency and tune the trap for dip on the meter. It has been the experience of the writer that complete alignment on stagger-tuned sets with this method is not accurate enough for service work.

Where the GDO shines is in checking condensers while the set is in operation. An eight inch loop of wire in series with a condenser of the proper capacity is hooked across the suspected condenser. See chart. Couple the grid dipper to the loop and tune to the frequency specified on the chart. If you can't get a dip near the frequency given in the chart, the condenser is bad. (The frequencies given on the chart may vary slightly from the frequencies at which the dip occurs because of differences in lead length and distance between the two sides of the loop. If the frequency varies too much, it would be well to compile your own chart.)

For that condenser you suspect of being intermittent, you can clip your loop across it, couple the grid dipper to the loop, and wait for the set to fail. When it goes out, a quick glance at the meter will show whether it is the suspected condenser or not. The added capacity across the condenser in the set will not throw the circuit off enough to bother the picture or sound to any appreciable extent. If the condenser in the set opens up, it is very possible the condenser in your loop will take over and do the job, so the set will not fail as long as the loop is clipped into the circuit. However, the meter will still show the condition of the condenser in the set. —30—

Frequency settings on the GDO when unit is used to check the condition of condensers. No dip on the meter shows that the condenser being tested is no good.

CONDENSER	SERIES CONDENSER	TUNE GDO TO
2.5 μμfd.	220 μμfd.	225 mc.
10 μμfd.	220 μμfd.	100 mc.
50 μμfd.	220 μμfd.	51 mc.
100 μμfd.	220 μμfd.	42 mc.
220 μμfd.	220 μμfd.	31 mc.
390 μμfd.	.001 μfd.	22.5 mc.
470 μμfd.	.001 μfd.	19 mc.
680 μμfd.	.001 μfd.	17.5 mc.
1000 μμfd.	.001 μfd.	16 mc.
.002 μfd.	.005 μfd.	9 mc.
.005 μfd.	.005 μfd.	7 mc.
.01 μfd.	.005 μfd.	6.2 mc.
.02 μfd.	.005 μfd.	5.5 mc.

China; these periods are over 100 kw. transmitters. (WRH)

French Equatorial Africa—Brazzaville, 11.970, noted with news 0015. (Hoffman, N. Y.)

French West Africa—WRH says *Radio Dakar* has been logged on 7.198 with news in French 1515; verified this channel with new QSL card.

Noted on 11.896A with French news now at 1800 and signing off around 1813. (This is an additional news period.) (Bellington, N. Y.) Noted at good level from 0130 with all-French session, mostly music. (Saylor, Va.)

Germany—Hamburg, 6.270, is heard in Sweden around 0400. (Engberg) *Radio Free Europe* now operates on approximately 9.080 at 1500 and on 5.960 around 1000. (Engberg, Sweden) *Leipzig*, 9.728A, noted from around 2300 with fair signal. (Cox, Dela.)

Greece—The North American transmission from *Radio Athens*, 9.607, at 2000-2100, is only poor to fair; news in Greek 2002 and 2055; news in *English* 2043-2055; fills in with music; has severe QRM. (Kary, Pa.) Heard on this channel with *English* 1430, French 1445. (Pearce, England)

Guatemala—TGNA uses 9.668 and 11.850 for *English* daily 2200-2230; Wednesday's Mailbag feature ("Script by You") runs around 2230-2300; still asks for reports. (United 49'ers Radio Society) TGWA, 9.760A, noted recently ending *English* session at 2259 (may be *only* Mon., Wed., Fri.) (Bellington, N. Y.) TGWB, 6.180A, is heard at fair level to 2300 when has interference from Munich, 6.185. (N. Z. DX Times)

Hawaii—WWVH, 10.000, Maui, noted recently through WWV's modulation at 2230. (Peddle, Newfoundland)

Holland—Radio Nederland, 9.59, noted with news 2130. (Hord, Ind.) Heard on 15.220 at 1050 with program in Dutch; weak to fair. (Cox, Dela.) Heard on 11.730 at 1630 with *English*, good level. (Baetz, Ill.)

Honduras—HRP1, 6.354, San Pedro Sula, noted lately with improved signal; news in Spanish 2230. (Ferguson, N. C.)

Hong Kong—ZBW3, 9.525, heard best around 0530-0630. (Sanderson, Australia)

India—Engberg, Sweden, notes Delhi with news 0300 on 17.760 parallel with 17.740.

AIR, 11.850, noted with news 1930. (West, Virginia) Parallels 15.290.

Delhi, 15.160, noted in External Service to East Asia, Southeast Asia, Australia, New Zealand opening 2030.

Indo-China—"Voice of Vietnam," Saigon, is noted on 9.62 and 7.09A with news daily 0845-0900 sign-off; at present, 9.62 is best signal. (Balbi, Calif.) *Radio France-Asie* noted on 11.924 with French news 1745; on 15.420 at 0500 with (*English*) news, music. (Sanderson, Australia)

Iran—Radio Teheran is now broadcasting its Overseas Service over EQA, 896 kc., EQB, 6.155, and EPB, 15.100—1345 *English*, 1400 Persian, 1430 German, 1445 French, 1500 *English*, 1515 Russian; EQB is "announced" as 6.16.

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(WRH) EPP, 3.835, Teheran, noted through ham QRM at 2130-2200; frequency varies a great deal. (Peddle, Newfoundland)

Iraq—In verifying, *Radio Baghdad* stated that the *English* session ("Date With Baghdad") opens 1413 with the song of the Bulbul (the nightingale of Iraq). Station operates on 11.724 and closes 1500. (Pearce, England)

Israel—Tel Aviv, 9.010A, still noted with *English* 1515-1600 sign-off. (Saylor, Va.)

Italy—*New* schedule for *Radio Italiana's* European Service is 0615-0715, 6.010, 9.570; 0810-0910, 6.010, 7.110, 9.570, 9.630, 11.900; 1220-1710, 6.010, 9.570, 11.900 (with French 1340-1420, German 1420-1500, 1620-1640); 1245-1340 on 11.810, 15.400 (*English* 1245-1320), 1415-1615 on 9.630, 11.810; 1620-1710 on 11.810, 15.400 (Portuguese 1620, Spanish 1645); 2215-2245 Russian on 6.010, 7.110, 9.710, 11.900, 15.400. (WRH)

Rome, *measured* 17.802, noted with news when tuned 1510; news ended 1520, then had talk; continued with music 1525; good signal in N. C. Heard on 15.400 at 1244 with interval signal followed by news to 1300 after which had a talk. (Ferguson) Heard at nice level closing down 2200 on 11.81. (Lund, Iowa) Noted with news to Britain, Ireland 1245-1300 on 15.400. (Cox, Dela.) Heard at excellent level 1930 on 11.905A. (Golden, Mass.)

Italian Somaliland—Mogadishu, 7.385A, noted around 1220 tune-in to 1300A closedown; news in Italian 1225. (Pearce, England)

Japan—The Japanese Standard Frequency Station JJY, Tokyo, broadcasts 1600-0600 on 4.000 and 8.000; every ten minutes has radio propagation warning in Morse code; has been testing at 1900 on Mondays on 2.500, Wednesdays 5.000, Fridays 10.000; power of each outlet is 1 kw. (Wada, Japan, via WRH)

According to verification, the Far East Network, AFRS, Tokyo, is now on the air 1600-1800, 6.080, 4.860; 0815-0330, 11.825, 9.605; 0345-1000, 4.860. (WRH) *Radio Japan*, 15.235, has strong signal on West Coast in the North American period 0000-0100; 11.705 is parallel. JBD3, 15.225, has fair level in Home Service from 2200 onwards. (Balbi, Calif.) *Radio Japan* is noted daily 1030-1130 using announced JOB2, 11.705, and JOA2, 9.675; news is 1030-1045, then 5 minutes of commentary, followed by 15 minutes of Japanese music; at 1105 uses Japanese until 1130 sign-off. (Graybill, Wash. State) Heard on 7.180 in *English* 0700, fair level in Missouri. (Boggs) JKI, 4.910, Nazaki, has been coming in at fair level lately from 0300 with programs in Japanese. (Saylor, Va.)

Kashmir—*Radio Kashmir*, Srinagar, is now scheduled 2130-2330 (Sun. to 2345) on 4.860; 0100-0230, 6.110; 0630-1200, 3.335. (WRH)

Kenya Colony—Forces Broadcasting Service, East Africa Command, 7.265, Nairobi, noted 2302 with BBC news relay. "Nairobi Calling," 4.855, heard

An active DX-er—Lee Neeley of California.

with BBC news relay 1300; closes down 1500 with "God Save the Queen." (Pearce, England)

Lebanon—Beirut, 8.036A, noted with news in French 1400; news in Arabic 1300. (Pearce, England)

Luxembourg—*Radio Luxembourg*, 6.090, noted with sponsored programs in *English* 1600. (Pearce, England)

Malaya—BFEBS, Singapore, noted at fine level on 15.435 at 0845, good on 11.955. (Balbi, Calif.) Heard on 9.690 to 0615 sign-off when announced was parallel 6.175; good level. (Ferguson, N. C.) Lists current schedules as daily to India, Pakistan 0800-0900 on 17.755; 0915-1030, 15.435; 1030-1145, 17.755, 15.435; to Burma and Thailand daily 0800-0815 on 11.955, 7.120; 0815-0900, 7.120; 0900-1030, 11.955; 1030-1145, 11.955, 7.120. To offset poor reception conditions from London, BFEBS has been relaying BBC news 0800-0815 on 11.820 to listeners in Australia and the Islands. (United 49'ers Radio Society)

Monaco—*Radio Monte Carlo* is now on the air Sundays 0100-1730; weekdays 0100-0310, 0600-1730; on Fridays Saturdays remains on air to 1800. (Engberg, Sweden)

Mozambique—Lourenco Marques still noted on 9.795A with Portuguese session around 0030. (Bellington, N. Y.) *English* session noted on 11.760 around 2345. (Kary, Pa.) Opens weekdays 2300, Sundays 0000 and parallels 4.913A which is also audible in Eastern USA.

Pakistan—*Radio Pakistan* noted on announced 9.484 at 1500-1600 sign-off with program of Western symphonic music; is interspersed with Arabic recordings; weak to fair with severe QRM. (Kary, Pa., Ferguson, N. C. others) Still tests to Turkey and United Kingdom 1430-1600 on 7.010, 9.484. Is heard on these channels also 1210-1230 with news at slow speed, and in Arabic to 1400 or later. (Pearce, England) *Radio Pakistan* has recently been heard on a *new* channel of 6.195 until 1030. (Engberg, Sweden) Karachi, 7.095A, noted 2130-2200. (Peddle, Newfoundland) And on 11.845 to 0915 or later. (Stark, Texas) Noted by Sanderson, Australia, on 15.325 at 2130 with news, music; this one is believed to be Dacca.

Pakistan heard testing around 2015-2100 or later on 11.885 (squeezed) and 15.335; has news 2130. (Kary, Pa., others)

Panama—HOLA, 9.505, Colon, noted opening 0645 in Spanish. (Ferguson, N. C.) And ending *English* 2203 and then going into Spanish. (Cox, Dela.)

Peru—OAX4T, 9.562, noted 1900 at strong level in Mo. (Boggs) OAX4Z, 6.082, heard to 2355 and at times to 0055 at good strength. (N. Z. DX Times) OAX4J, *Radio Colonial*, 9.330, noted fair recently 2100-0200 fade-out; all-Spanish. (Saylor, Va.)

Philippines—QRA for *Radio Free Asia* in Manila is P.O. Box 3161. This one is noted by Balbi, Calif., irregularly on 11.940A and daily on 6.11 with *English* 0845-0900. The Guam outlet, 9.490, has been heard by Dilg, Calif., and at 0920 sign-off announces a call that seems to be KUJZ; CWQRM is severe. Current schedule of RFA is 0700-0920.

Far East Broadcasting Co., Manila, lists schedule of 1600-0100, 0300-1200 over DZB2, 3.32; DZH6, 6.03; DZH7, 9.73; DZH8, 15.300; DZH9, 11.855. (Boggs, Mo.) Since BFEBS, Singapore, Malaya, has vacated 15.300, DZH8 is sometimes audible to readable here in West Virginia around 0700.

DYH2, 6.140, Cebu, noted with weather report, news 0500. (Sanderson, Australia)

Poland—Radio Warsaw, 11.915, noted with *English* to North America 1700; however, announces "11.8." (Hord, Ind., others) A "revised" summer schedule from *Radio Polskie* lists *English* for North America as 0715-0800, 15.120; 1700, 1730, 1930, 2315, 0030 all on 11.815. (Golden, Mass.)

Portuguese India—The Commercial Service of *Radio Goa* is heard at good strength in Sweden 0030-0400 with request program in *English* for listeners in India on the *new* channel of 17.890. (Engberg)

Portuguese Guinea—CQM, Bissau, is now listed on both 5.838, 6.160, according to verification received recently. (Radio Sweden)

New Caledonia—Sanderson, Australia, reports *Radio Noumea* on 6.000 with French session 0400.

(*Continued on page* 112)

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20-20	25	.16
20-20	150	.23
20-20	300	.21
20-20	350	.21
20-20	450	.49
150-50-25	150	.49
10-10-10-10	350	.21
40-40-20-2	150	.28
20-15-15-15	300	.28
20-10-10-10	350	.32
4/20	450/350	.55
40/20	150/25	.21
40/50	400/300	.28
40/50	450/50	.65
250/1000	10/6	.30
50-10	450/25	.26
20-10/10	150/25	.23
20-10/20	450/25	.26
20-15/20	350/25	.18
25-15/10	450/350	.23
20-16/25	450/50	.23
20-40/150	400/50	.45
120-60/20	150/25	.45
30-30-15/30	300/50	.39
40-40-20/20	350/15	.28
40-40-20/50	300/25	.28
40-40-20/200	150/10	.39
40-40-30/20	150/25	.36
40-40-30/100	150/25	.36
1/1/1	475/100/100	.23
10/50/100	350/100/50	.23

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DM33A	28	7	540	.250	BC 456	
PE101C	13.26	12.6	400	.135	SCR515	
		6.3	800	.020		
DB AR 93	28	3.25	375	.180		
23350	27	1.75	285	.075	APN-1	
ZA0515	12.24	4/2	500	.050		
B-19 pack	12	9.4	275	.110	MARK11	
			500	.050		
D-104	12		225	.100		
			440	.200		
DA-3A	28	10	300	.060	SCR522	
			150	.010		
			14.5	.5	APN-1	
SO53	28	1.4	250	.060	BC-375	
PE73CN	28	19	1000	.350		
CW21AAX	18	12.6	400	.135		
	26	6.3	800	.020		
DM-34	14		220	.080	SCR528	

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2	3AG	.03	.25	1.95
3	3AG	.03	.25	1.95
4	3AG	.03	.25	1.95
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15	3AG	.03	.25	1.95
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1	4AG	.05	.40	2.95
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15	4AG	.05	.40	2.95
20	4AG	.05	.40	2.95
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New Zealand—When this was compiled, ZL4, 15.280 (to Pacific), and ZL10, 15.220 (to Australia) were coming through fairly well around 2005 and later. (Kary, Pa., others)

Nicaragua—YNVP, 6.758, noted at fair level 2340 in Spanish. (Hoffman, N. Y.)

Nigeria—Lagos is *testing* on 6.100 at 0000-1115 and on 4.990 at 1145-1700; the 7.255 outlet is audible in Britain from around 1430 to closedown 1715; has BBC news relay 1500. (Radio Amateur, London)

North Korea—The Pyongyang Central Broadcasting Station now uses 4.400 and 6.250; programs are mostly in Korean but Japanese is heard 0830-0900. (Wada, Japan, via Radio Australia)

Norway—Radio Norway, 15.175, Oslo, noted opening 2000 with program for Norwegians abroad, specifically in North America and North Atlantic waters. (Kary, Pa.) LLK, 11.850, is fair level around 2100. (England, New Hampshire)

Roumania—Radio Bucharest is noted on 6.208 (listed 6.210) at fair strength to closing 0700. (Engberg, Sweden) Heard with *English* 1400 on *new* channel of 12.032A in parallel with 9.252, 6.210A. (Pearce, England)

Sao Tome—CR5SB, 17.677, still noted Sundays in Portuguese 0700-0800. (Pearce, England)

Saudi-Arabia—Djeddah is noted in Sweden at good strength around 1115 on 11.950, 11.850. (Engberg) Also heard by Pearce, England.

South Africa—Johannesburg, 4.895, is noted from 2345-0045 in Afrikaans. (Saylor, Va.) *"Springbok Radio,"* 4.945, is at fair level some days around 2345 in *English;* uses commercials, has frequent time checks.

Spain—Radio S.E.U., 7.140, Madrid, 0.8 kw., has Ukrainian session on Tue. 1430-1500, has Esperanto on Wed. 1430-1500, is in French on Thur. 1430-1500, and in Portuguese on Sun. 0800-0830; news in Spanish is daily 1635-1645. (WRH) *Radio Nacional de Espana*, 9.363, Madrid, noted signing off second *English* period for North America at 2245; fair strength in Oregon. (Gardner) Cadiz, 7.200, is heard well in the United Kingdom until 1800 closedown. (ISWC, London)

Sweden—Radio Sweden, 11.705, noted coming on air 2300 to Australia; opens in *English*. (Gardner, Ore.) Noted with *English* on 11.88 at 1900; fair level but bad QRM. (Lund, Iowa) Heard on 15.155 with *English* 1600-1630; some QRM. (Graybill, Wash. State) Heard with *English* on 15.155 at 0700 and again 0900. (Ferguson, N. C.)

Switzerland—SBC is again using HED7, 15.12, at 1145-1330; rather good strength in Sweden. (Engberg) Noted at good level here in West Virginia; ends *English* session around 1220.

HEI3, 7.210, heard 2210 at good level in North American beam. (Hoffman, N. Y.)

Syria—Boggs, Mo., reports Damascus on 7.145 at fair level at 0735; on 11.913 at 1630 (beginning *English* pe-

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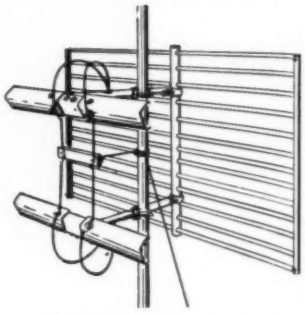

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riod) with strong signal; signs off 1730.

Engberg, Sweden, says *Radio Damascus* is noted irregularly around 1200 on 9.525.

Tahiti—Radio Tahiti, 6.980A, Papeete, is again audible around 0000-0100 in parallel with 6.135. (McPhadden, Calif.) Noted on 6.980A around 0050-0130 sign-off; mostly in French; closes with "La Marseillaise." (Kary, Pa.)

Taiwan—BED3, 15.235, fair 2300-2400 in *English*; from 2400 has QRM by *Radio Japan*. (Balbi, Calif.) BED26, 10.080, noted 1700 with American marches, then news in Chinese, music. (Sanderson, Australia) Taipeh, 11.735, noted 0800 at fair level. (Boggs, Mo., others) Engberg, Sweden, says Taipeh is operating now on 11.915A in Chinese to 1115; has QRM from Rome on 11.905.

Tangier—Pan-American Radio is now on 7.290, 2 kw., daily 0700-1000, 1500-1900 in Spanish, French, *English*. (WRH) *Radio Africa*, 7.126, noted 1638 in Swedish; at 1705 goes into Spanish and French. (Pearce, England)

Thailand—Bangkok, 6.240, noted 0615 with news; parallel on 11.960. (Sanderson, Australia)

Trinidad—Radio Trinidad is installing *new* equipment and during the next few months will be making changes in *both* power and frequencies. (Radio Amateur, London)

Turkey—Radio Ankara's English program for Western Europe is noted now around 1600-1645 on TAU, 15.160A, excellent level; in Turkish 1645-1700 sign-off. (Kary, Pa.) TAP, 9.465, parallels but has poor level and much CWQRM here in West Virginia. According to WRH, has German 1445-1515; French 1515-1545; Turkish 1545-1600; *English* 1600-1645; Turkish 1645-1700 over TAU, 15.160, and TAP, 9.465; *English* for USA-Canada is still on TAT, 9.515, 1815-1900.

USI—Ambon, 11.097A, is still noted around 0645 to 0800 or later; some days fades in *before* 0500. (Stark, Texas) Programs in *English* are radiated daily by *Radio Republik Indonesia*, Djakarta, on 4.910 and 15.150 at 0600-0700; on 4.910, 11.770, 15.150 at 0930-1030; for Europe and New Zealand on 11.770 and 15.150 at 1400-1500. (Radio Sweden, others)

USSR—Moscow, 11.920, noted in Turkish session 1250 and heard to 1300, then in German. Noted on 11.950 with news in Spanish at dictation speed to 2130 sign-off; a channel of 11.980 is noted beginning relay of the "main" Home Service with news in Russian 2205. (Kary, Pa.) Yakutsk, 5.980, noted 2350 with program in Russian; weak level, slight heterodyne. (Cox, Dela.) Moscow *announces* these outlets for its "evening" beam to North America in *English* 1820-0100—15.33, 15.25, 15.23, 15.11, 11.91, 11.83, 11.81, 11.71, 9.67, 9.65, 9.55, 7.24; news is listed for 1830, 2000, 2100, 2200, 0000, 0030. (England, New Hampshire) (Some of these outlets are satellite countries relaying Moscow.—KRB)

Vatican—HVJ has *English* daily 1000 on 9.646, 11.740, 15.120; at 1315

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1619	19c	E1148	49c	9006	19c
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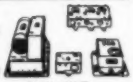
SCR-274N COMMAND and ARC-5 EQUIPMENT



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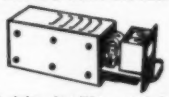

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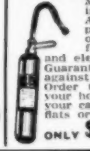

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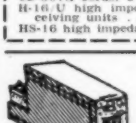

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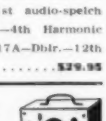

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PHONES: WO 4-0827 and WO 4-0828

on 5.968, 9.646, 11.740; also Tuesdays 1030 on 11.740, 17.840. (Engberg, Sweden) Noted on 9.646 with German 1445. (Ferguson, N. C.)

Venezuela—YVNB, 4.820, Coro, noted announcing at 0615; YVMM, 4.910, *Radio Coro,* is heard to *after* 2030. (Stark, Texas)

Yugoslavia—Radio Yugoslavia, Belgrade, recently sent QSL by registered mail. (Harris, Mich.) Noted on 9.505 with bad QRM, with news 1645. (Bellington, N. Y., others) Summer schedule is 6.100, 0830-1030, 1630-1845; 6.150, 2300-0015, 1700-1800; 7.240, 0130-0230; 9.505, 1030-1300, 1600-1800; 11.735, 1315-1545; *English* is at 0215-0230 on 7.240; 1100-1115 on 9.505; 1315-1330 on 11.735, and 1645-1700 on 6.100, 9.505. (WRH)

* * *

Press Time Flashes

Predicted Zurich Sunspot Number for August is 49, down 2 from July. (Stark, Texas)

The first transmission of "Sweden Calling DX-ers" is now aired Fridays 1045 over 6.065. (Radio Sweden)

A powerful "clandestine" outlet is noted in Sweden on 6.680 opening 1100; probably is located in Yugoslavia. (Engberg) *Radio Espana Independiente* is currently noted on approximately 14.880 with news in Spanish 1730; unusually strong level in Pa. (Kary)

SWL's who sent reports to the *"Courier,"* VOA's "Floating Truthship," on reception of test transmissions some weeks ago when the ship was in Panama Canal Zone waters, are receiving cards which show the Coast Guard insignia and a sketch of the *"Courier."* (Bellington, N. Y.)

Radio Indonesia, Djakarta, USI, states it will put a *new* 50 kw. transmitter into service in October; the *new* 100 kw. transmitter will be located at Kelejoran, near Djakarta. (N. Z. DX Times)

Radio Sweden says the Home Service of *Radio Eireann,* Ireland (Eire), is now heard in Europe on 3.400, 5.110 around 0800-1700; may be harmonics.

HJEF, Cali, Colombia, is noted on 4.765 to 2300 sign-off weekdays, to 0100 Sundays. (Cushen, N. Z.)

HCJB, Quito, Ecuador, is now operating in the 31-m. band on 9.745A (moved from 9.970A); now is on the air most days to 0300 (last hour and a half in *English*); by this time should have ceased use of 12.455 (10 kw.) and should be using a *new* frequency of 11.915. (Boice, Conn.)

Radio Pakistan still noted *testing* to Indonesia 0630-0715 on 17.835, 15.270; with news 1015-1030 on 11.845 (probably moved from 11.675); with news 0200 on 17.710A. More recently was noted using 11.914 (instead of 7.010) in parallel with 9.484 with the *test* period for Turkey and Britain at 1430-1600. (Pearce, England)

"Voice of Free China," 11.920, now has *English* 1320-1345 (schedule is one hour *earlier* than formerly); Chinese music 1400; news in Arabic 1420; Russian (jammed) at 1350. (Pearce, England)

BFEBS, Singapore, 11.955, Malaya, noted signing on 0700 at weak level.

CIRCUIT IMPROVEMENT

By GEORGE A. OSMUNDSEN

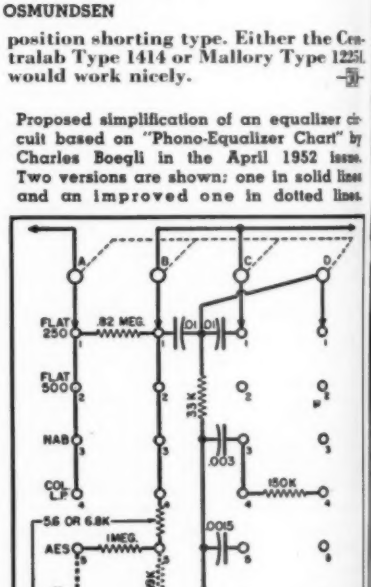
I HAVE built one of the amplifiers suggested by Mr. Boegli into a control unit and am very pleased with the result. Being cramped for space, it occurred to me that with so many elements in common, a considerable reduction in size could be effected if a suitable switching arrangement could be developed.

The circuit diagram, as shown in the solid lines, is based on Mr. Boegli's new chart and is the one I used in building up my present unit. The new data simplifies the problem somewhat and, except for the Columbia LP characteristic, could be made up on a 3-gang switch.

Since Mr. Boegli's latest article mentioned the use of a 3-gang switch as a means of making the unit more compact, I thought I would pass along a few additional changes I made (shown dotted in the diagram).

Lug "D" can be used as a tie-point for the junction of the two .01 μfd. condensers and the 33,000 ohm resistor. Any of the spare contacts (C2, D1, D2, D3, or D5) may be bent down, broken off, or otherwise altered so as not to make contact. These contacts can be used as a ground terminal for connection to a common ground bus. A .003 μfd. condenser, connected between switch points C4 and C5, may be used in place of the .0015 μfd. condenser shown connected between C5 and ground. The switch used in this simplified version is a two-deck, 4-pole, 5-position shorting type. Either the Centralab Type 1414 or Mallory Type 1225L would work nicely.

Proposed simplification of an equalizer circuit based on "Phono-Equalizer Chart" by Charles Boegli in the April 1952 issue. Two versions are shown: one in solid lines and an improved one in dotted lines.



OTM2, 9.380A, *Radio Congo Belge*, Leopoldville, Belgian Congo, heard 1440 to after 1500 with uninterrupted recorded music. (Kary, Pa.)

Radio Nederland, 9.59, noted on Saturdays at 2230 with Mail Bag program; good level; also heard on 15.220 at 1100-1140 with *English* to Africa, Asia, much fade but readable. *Radio Sofia*, 15.33, Bulgaria, noted signing off in *English* 2315, good level. (Alcock, Ky.)

Radio Peking, 15.06A, noted with *English* by woman at 1745, weak signal; not audible at that time on 11.69A, 10.260. ZL8, 9.62, Wellington, New Zealand, is now used instead of ZL3, 11.78, from 0200 onwards in parallel with ZL10, 15.22; *Radio Sofia*, 15.33, Bulgaria, heard with news 0100; signal fair; signs off 0115. (Balbi, Calif.)

Radio Nacional de Espana, 15.620, noted 1045 in Spanish with S-6 signal; is Madrid. Montevideo, 11.835, Uruguay, noted in Spanish signing off 2200; 4VRW, 9.988A, Port-au-Prince, Haiti, heard 1100, and found there also when rechecked 1400 and 2145. (Cleveland, Md.)

* * *

Acknowledgement

Thanks for the fine reports. *ISW DEPARTMENT* monitor cards for 1952-53 are now being sent out to *active* reporters; they are *gratis*—and *newcomers are welcomed!* Send reports to Kenneth R. Boord, 948 Stewartstown Road, Morgantown, West Virginia, USA. . . . . K.R.B.

HAMFESTS SCHEDULED

THE Federation of Long Island Radio Clubs, Inc., representing nine radio clubs on Long Island and in Brooklyn, has scheduled its 16th annual hamfest and dance for Friday evening, September 12th, at Lost Battalion Hall, Elmhurst, Queens.

Hams from the metropolitan New York area as well as those from other sections are invited to attend. A prize will be awarded to the amateur coming the greatest distance to attend this affair. Tickets are $2.00 for hams, and $1.25 for XYL's when ordered in advance. An additional 50 cents will be collected on each ticket sold at the door. Tickets may be obtained from Julian N. Jablin, W2QPQ, FLIRC Secretary, at 147-14 Charter Road, Jamaica 35, New York.

* * *

THE Baltimore Amateur Radio Club is holding its fifth annual hamfest-picnic at Triton Beach, Mayo, Maryland on Sunday, August 10th. Tickets are $1.00 with 50 cents payable at the entrance to the beach and the balance payable at the pavilion. This fee includes bathing, bath house, and locker facilities, and the use of the picnic tables and pavilion.

Prizes will be awarded for the best home-made mobile installation and the best commercially-built installation. There will be an interesting variety of contests for all. The affair will start at 10:00 a.m. and all hams are invited to pack a picnic basket and join the fun.

For full details write Chairman Ernie Dobos, W3JCL, 2208 N. Fulton Avenue, Baltimore 17, Md. -30-

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Adheres to any surface. Ceiling, attic, closet, etc. Electronically switch-beamed to cover 360° area. Flick of switch clears picture on any channel. Model ID-303. You get antenna, selector switch, 25 ft. lead-in. COMPLETE — NOTHING ELSE TO BUY.

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Highly directional and closely tuned to each channel. Cuts interference and noise to a minimum. Five elements; one folded dipole, three directors and one reflector. Individual array for each channel desired.
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Fundamental thru 110 mc. 330 mc on Harmonics
Audio: 20-20,000 cycles. Cathode follower output; variable per cent modulation. Stepping attenuator. External modulation. Speech amplifier, crystal marker. $33.95 630 K Kit...
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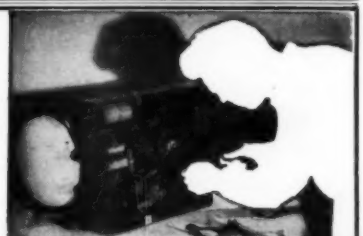
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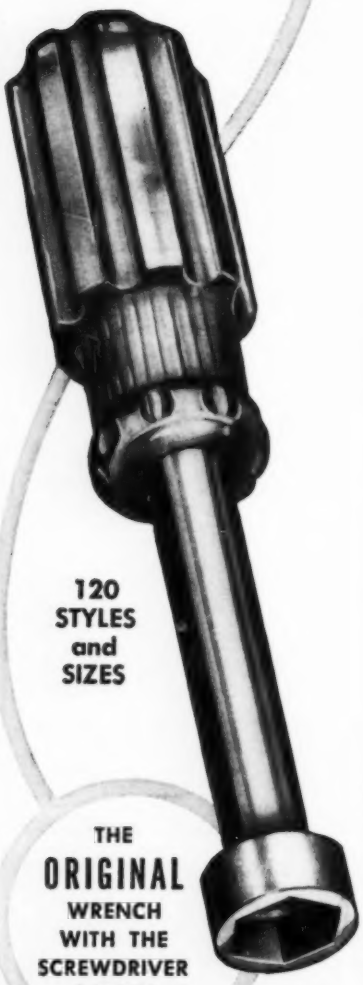

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Cinemagnetic Recording

(*Continued from page 47*)

operated from 117 volts a.c. but other models are available which can be operated from 220 volts a.c., 50 or 60 cycles, and also from d.c. for location work. It can be adjusted to handle 16, 17½, or 35 mm. film at the normal speeds for these film widths. A special feature of the recorder is that the takeup and feed spindles can be quickly set in another location so they will handle 1500 feet of film. At 45 feet-per-minute or at the normal 16 mm. speed of 36 feet-per-minute, a continuous half-hour program can be recorded. This is quite important to the growing television film industry. Figs. 3 and 4 show detail construction of the recorder.

The mixer amplifier (Fig. 1) provides two microphone inputs; high level mixing; dialogue equalization; high and low-pass filters; oscillator for channel line-up; audio slater and talkback system; intercom between mixer operator, recordist and microphone boom man; and monitoring from either the direct signal or from the recorded signal at the press of a button. The recordist monitors from the recorded track during a take and his headphones are automatically switched back across the line when the recorder is stopped so that he can be aware of what is taking place on the stage. In short, all of the convenient features for doing production recording are provided in this channel of equipment.

As pointed out previously, all the "OK" takes on the magnetic film are transferred to photographic tracks. These are then edited and made ready for re-recording. At this stage of the process, magnetic film has again been found very helpful in saving time and doing a better job. Dubbing or re-recording a picture for release involves mixing together at least three and perhaps as many as twenty or more different soundtracks. Controlling the level, frequency response, and possibly the amount of compression of all of these tracks places a severe burden on the mixer operators. The use of magnetic film makes it possible for these mixer operators to play back immediately the results of their efforts rather than wait until the next day as is necessary when using the photographic process. Dubbing mixer operators are enthusiastic about the use of magnetic film for this purpose since it represents an improvement in quality as well as a significant saving in time. When they have dubbed a reel satisfactorily on the magnetic film, it is then transferred to the photographic release negative.

Still another extensive use of magnetic film is for the storage of soundtracks. It is becoming common practice to record the three separate soundtracks of a picture on one piece of 35 mm. film. *RCA* was the first to supply equipment for this purpose. All of the

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MARKER BEACON RECEIVER: BC-357, used 5.00
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dialogue is recorded on one track, the music on another, and the sound effects on the third. Such a film is quite useful in making foreign versions where the dialogue can be omitted but all of the other sounds are mixed together at the proper level.

Engineering knowledge is available to introduce magnetic soundtracks into the theaters on the release prints. It would of course be necessary to modify theater equipment to reproduce magnetic soundtrack and in many theaters the sound systems should be improved to benefit from the extended volume and frequency range of such magnetic soundtracks. It would cost more to re-record the magnetic soundtrack on each release print than it now does for the photographic track because the photographic soundtrack is printed simultaneously with the picture in the same machine on the same film stock, whereas a magnetic strip would have to be applied to the film and the magnetic soundtrack re-recorded thereon.

However, magnetic sound recording is developing rapidly, and many new devices are now being designed to make better use of magnetic film. This will undoubtedly continue because this new medium of sound recording offers so many possibilities not readily attainable with the photographic process.

—30—

A SUGGESTION

By RAYMOND D. BRYANT

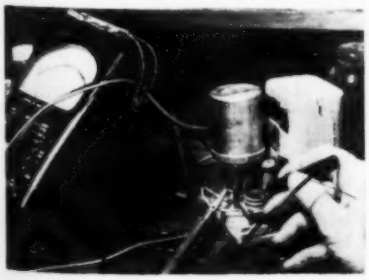
HAVING noticed an item on page 173 of your May 1952 issue (TV Troubleshooter), I wish to offer my comments.

The idea of the so-called trick is good, so good that I've been using it for a year and a half. However, I am convinced that I obtain better results. Plastic alignment tools, being somewhat soft, do not give the best results. I find that with a ¼-inch diameter fiber alignment tool with a plastic handle, I can locate internal arcing in the windings of a high voltage transformer, arcing or leakage in a high voltage filter condenser, arcing in "open" high value resistors, etc.

It seems the fiber will reproduce and conduct the vibration better than will the softer plastic materials. I hope other readers will benefit from my experience in this matter.

—30—

A simple method for keeping tester leads from draping over the meter scale, as suggested by Fred J. Lingel, W2ZGY. As the picture shows, this is done by running the leads through the slot in the end of the leather carrying strap. It also prevents the accidental disconnection of the plugs when there is too much tension on the lead wires.



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NEW TV PRODUCTS on the Market.....

REPLACEMENT PARTS

Standard Transformer Corporation, 3580 Elston Avenue, Chicago, Illinois has announced the availability of fourteen new television replacement components.

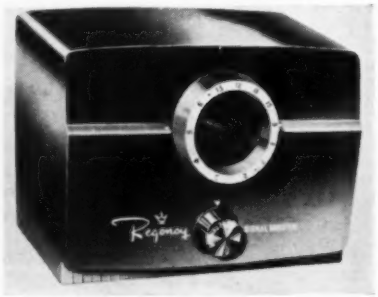
The new additions to the line include six power transformers, two filament transformers, two horizontal deflection and high voltage transformers, two filter chokes, a vertical deflection output transformer, and a width control with a.g.c. winding.

Replacement recommendations for these new units are listed in the new "*Stancor* TV Replacement Guide and Catalogue" which lists 2416 TV models and chassis.

NEW REGENCY BOOSTER

A new and exclusive circuit stabilizer is the principal of ten features of the new television signal booster made by the *Regency Division* of *I.D.E.A., Inc.,* 7900 Pendleton Pike, Indianapolis 26, Indiana.

The stabilizer provides both inductive and capacitive neutralization to assure maximum stability on all 12 v.h.f. channels. Other features of the new Model DB-520 include ease of installation with the TV set plugging into the booster and the booster into the wall outlet; an "on-off" switch of 3 amp. capacity; a single tuning knob; a push-pull triode in a balanced circuit; link coupling for optimum impedance match; improved circuit control for greater tracking accuracy; a compact cabinet; and a broadband response. This model carries *UL* approval.



TV BYPASSES

Erie Resistor Corporation of Erie, Pa. is offering two new high voltage "Ceramicon" TV bypass condensers which have been designed especially to supply high voltage power supply filtering for television receivers.

The Style 412 is rated at 20 kv. and the Style 414 at 10 kv. The case insulation is of low-loss, molded thermosetting plastic, which provides excellent moisture sealing properties. Ring convolutions are molded into the surface of the 20 kv. condenser to prevent surface leakages that are caused by ordinary handling and a consequent deposit of conductive materials.

A catalogue covering these bypass condensers is available on request.

MARKER GENERATOR

Precise Development Corp., Oceanside, New York is now in production

on an r.f.-a.f.-TV marker generator, the Model 630.

Available in kit form, the Model 630 will reach 110 mc. on fundamentals and 330 mc. on harmonics. The unit is furnished with the r.f. head preassembled and calibrated.

Audio frequencies from 20 to 20,000 cycles can be measured with the modulation variable in both per-cent and frequency from 20 to 20,000 cps. The unit has a cathode-follower output, stepping attenuator, external modulation, speech amplifier, crystal marker, and crystal amplitude control. The circuit also incorporates r.f. and a.f. standby, a Wien bridge a.c. oscillator, a Colpitts r.f. oscillator, individually tuned coils, constant output impedance, vernier tuning on a.f. and r.f., a separate r.f. section, and complete shielding. Each band is separately loaded for constant output from range to range.

NEW TRIO PRODUCTS

Trio Manufacturing Company of Griggsville, Illinois has just introduced three new products in its line of TV equipment.

The new units include a television rotator and direction indicator, a new all-aluminum tower, and an accessory control unit.

The rotator which utilizes two heavy-duty 24 volt motors, will support the heaviest arrays even in 80 m.p.h. winds. A positive-acting electrical stop at both ends of the 360 degree turn eliminates lead damage. The rotator may also be used for the 10, 6, and 2 meter ham bands. It turns at 1 rpm and can be fastened to any pipe up to 2" o.d.

The all-aluminum tower weighs less than one pound per foot. The tower may be raised from a horizontal position in heights up to 40 feet. For additional height, sections can be added from the bottom. The tower comes in 5-foot sections: a bottom section, a top section, and as many center sections as desired.

The accessory control unit provides an automatic line switch for booster, rotator, TV lamp, or other accessories. By plugging the line cords from these accessories into the control relay unit, all such accessories can be turned on with the one switch controlling the TV set.

TV "SERVISET"

Lee Electronic Labs, Inc., 233 Dudley Street, Roxbury 19, Massachusetts has developed a handy, compact circuit analyzer which has been tradenamed the "Serviset."

The unit, which is self-contained, can be used as an r.f. and a.f. signal tracer, as an r.f. and a.f. signal injector, can measure a.c. and d.c. voltages from 0 to 20,000 volts in four ranges, indicate d.c. polarity, act as a low ohms continuity and short indicator, serve as a high ohms continuity and leakage checker, function as a substitute condenser or resistor, and check speakers or phones for acoustical coupling as well as continuity.

The Model EC is compact, light, and portable. It is simple to operate and has no controls to adjust. Its use will not load or detune the circuit under test.

The unit comes complete with an instruction manual; a high-impedance, high-sensitivity Alnico phone; special phone extension cord; an insulated "Klipzon" type extension tip; a high voltage adapter; a kinkless test lead with built-in lamp remover; and a fabric pouch which houses all of the accessories and the manual.

ASTATIC BOOSTER

The development of a new and improved television booster has been announced by the *Astatic Corporation* of Conneaut, Ohio.

Tradenamed the "Scanafar," the new booster is claimed to provide a

lower noise figure and higher gain whether used with new or old style receivers. The circuit is a balanced, cascaded type with a neutralized 6J6 tube driving a 6BQ7. Both tubes are

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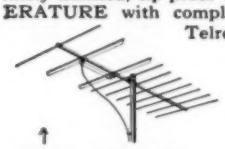
"BAT WING"

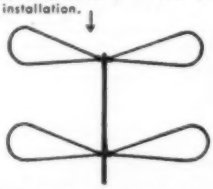
by telrex — the finest TOP-OF-SET antenna ever produced!

SUPER-PERFORMANCE! Beyond a doubt, the finest top-of-set TV antenna ever offered the trade. Outperforms any other indoor type and requires no tuning or pruning. No fuss, bother or time consuming adjustments. SUPERIOR STYLING! Featuring modern design that enhances any living room. Rich aluminum elements are mounted on a finely finished, tip-proof base. WRITE FOR NEW LITERATURE with complete information on the whole Telrex line for TV, UHF and FM.



NEW! Telrex "FISHBONE". Ten WORKING elements. Guaranteed to outperform any yagi on the market.

CLOVER-V-BEAM E-Z RIG design. A high gain, compact array for attic or outdoor installation.



← NEW! "CONICAL-V-BEAMS" WITH HI-V-REFLECTOR — UNIVERSAL SERIES — customized for your locality.

"CONICAL-V-BEAMS" are covered by Patent No. 23,346
CANADIAN and FOREIGN PATENTS PENDING

Originators and Manufacturers of "CONICAL-V-BEAMS" —INSIST on the original!

telrex INC.
CONICAL-V-BEAMS

AMERICA'S OUTSTANDING TELEVISION BEAM

ASBURY PARK 7, N. J.

NEW! MOSLEY WALL-THRU

For TV, FM and Amateur Transmission Line

- Fits Any Wall Up to 13" Thick!
- Completely Weather-Proof!
- For Standard Flat 300 Ohm Line or RG-59/U Co-ax Cable!
- MOSLEY Lead-In Socket Can Be Mounted Direct to Inside Plate!
- Precision Molded Polystyrene End Plates!
- Easily, Quickly Installed!

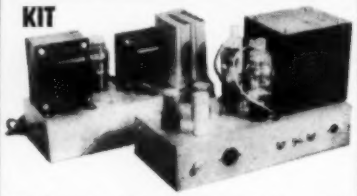
Cat. No. 625
List Price $1.95
Cat. No. 625-PK Wall Thru, complete with MOSLEY Universal TV Lead-In Socket and Plug.
List Price $3.00

MOSLEY ELECTRONICS
2125 Lackland Road Overland, Missouri

HARVEY

For the FINEST in AUDIO

WILLIAMSON HR-15 AMPLIFIER KIT



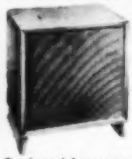
The famous, original Williamson HR-15 . . . still acclaimed the leader . . . in kit form, with the original Partridge output Transformer. Assemble this kit, and in 3 hours or less, enjoy the finest sound you ever heard. Operates from a tuner, phono-preamp, crystal pick-up, or other signal source. Absolute gain is 70.8 db with 20 db of feedback. Frequency response: ± .5 db, from 10 to 100,000 cps. Output impedances to match all speakers from 1.7 to 109 ohms. Kit is complete with 5 tubes (1-5V4, 2-6SN7, and 2-5881 (or 807 if requested), 2-Punched Chassis, 2-Resistor Mounting Strips, Sockets, Partridge WWFB Output Transformer, Assembly Instructions, and All Other Necessary Parts for Amplifier and Power Supply. $76.50

HR-15, as above, but with Partridge CFB Output Transformer (Hermetically Sealed) $90.00

PARTRIDGE OUTPUT TRANSFORMERS — Available Separately. WWFB..... $26.00 CFB..... $40.00

HR-15T WILLIAMSON Kit—Furnished as above, with TRIAD Transformers and Chokes $69.50

NOTE: HR-15 and HR-15T Kits may be had with British KT-66 Output tubes for $3.00 additional.



FIRST AT HARVEY!

The Sensational 'Hit' of the New York and Chicago Audio Fairs

***The New R-J* SPEAKER ENCLOSURE**

Designed for use with ANY 12 or 15 inch speaker, this new sensation in high-fidelity has no counterpart in anything available today. The R-J is a new concept. Large enough only to accommodate the speaker, it reproduces tones to the lowest limits of audibility, cleanly and without hangover. The R-J is the amazing solution to the problem of space versus quality.

Now Available for Immediate Delivery. Specify for 12 or 15 inch speaker.

Model FM (Mahogany) $49.95
Model FB (Blonde) 54.50

HI-FI PICKUP CARTRIDGES

AUDAX POLYPHASE

DL-6 "Chromatic"—.001" Diamond and .003" Sapphire Styli $41.70
L-6 Sapphires, 001" and .003" 20.70
KL-4 Same as L-6, but higher output (for record changers) 20.70

G. E. VARIABLE RELUCTANCE

RPX-040 Sapphire .003" $5.97
RPX-041 Sapphire .001" 5.97
RPX-050 "Triple Play"—.001" & .003" Sapphires 8.37

PICKERING

S-140S Sapphire .001" $15.00
D-140S Diamond .001" 36.00
S-120M Sapphire .0027" 9.90
D-120M Diamond .0025" 24.90
.001" for 33⅓ & 45 rpm
.003" & .0025" for 78 rpm

NOTE: In view of the rapidly changing market conditions, all prices shown are subject to change without notice and are net, F.O.B., N.Y.C.

Telephone hrc LExington 2-1500

HARVEY RADIO COMPANY, INC.

103 West 43rd St., New York 36, N. Y.

used over the entire TV frequency range.

Bandwidth is over 7 mc. on all channels. Two control knobs operate the booster, one an "on-off" switch and low or high band selector and the other a fine-tuning control. The metal cabinet is finished in simulated mahogany woodgrain and gold.

Additional information on the Model CT-1 is available from the company on request.

TV CABINETS

Standard Wood Products Corp., 43-02 38th Street, Long Island City 4, New York has added seven new period-style models to its Series 503 TV cabinet line.

One of the new cabinets is the Series 503 French Provincial. This unit will

house all 630-type chassis and other models of similar dimensions and all sizes of round and rectangular tubes. Like the other models in the line, this cabinet is supplied complete with all necessary mountings for the picture tube and yoke and can be furnished with a record changer pull-out drawer at the bottom at a slight additional charge.

The cabinets measure 40" high by 24" wide by 24" deep. The line is available in mahogany, walnut, ebony, or blonde finishes.

COLINEAR ARRAY

Fretco, Incorporated, 1041 Forbes Street, Pittsburgh 19, Pa. is now in production on a new television antenna which has been tradenamed the "Fretaray."

This broadband colinear array retains high gain on all channels. It is light in weight and of sturdy construction. One antenna will receive all channels. Only one transmission line is required. Assembly consists of tightening the unit and mounting it.

A data sheet on this new fringe area antenna is available from the company on request.

TV CONTROL LINE

International Resistance Company, 401 North Broad Street, Philadelphia 8, Pa. has announced a completely new TV control line which includes 295 factory-assembled "Exact Duplicate Concentric Dual Controls" individually packaged in uniform size cartons, each of which is marked with the manufacturer's part number as well as with the *IRC* stock numbers.

The new line also includes the company's "Concentripaks" with a special selection of universal parts for specific makes of TV concentric dual controls, all housed in a sturdy plastic box; a new dealer "Concentrikit" assortment in a standard *IRC* all-metal, four-drawer cabinet; and the Form SO12 which lists replacements by tradename and part number along with the *IRC* equivalent.

For complete information on the new control line, write for a copy of Catalogue DCIC.

ANTI-STATIC AGENT

A new anti-static agent developed by *Chemical Development Corporation* of Danvers, Massachusetts is now available for a wide variety of electrical equipment applications.

Although originally developed to eliminate dirt and dust attraction on plastic surfaces, it has been found that it can be used on glass, painted surfaces, and on other areas where charges accumulate.

The product can be applied by spraying, brushing, dipping, or other conventional methods; polishing is not necessary.

Tube and electrical instrument companies are invited to secure complete details on this new product by writing the company.

TV TRANSMITTER

The *General Electric Company* has announced the availability of a line of u.h.f. television transmitters which have been tailored to the needs of different sized communities.

A lower power transmitter for small towns is already in production at the company's Electronics Park plant at Syracuse, New York. Three models will comprise the line for the present, a 100 watt, a 1000 watt, and a 12,000 watt unit. A specially-designed antenna gives the three transmitters effective radiated powers of 1 kw., 100 kw., and 200 kw.

Under average conditions, the low-power u.h.f transmitter and the special *G-E* antenna will provide satisfactory reception 8 to 10 miles away.

TV MAST

The Baker Manufacturing Company of Evansville, Wisconsin has added a new unit to its television mast line.

The 10 AM is a ten-foot mast with a special tapered joint for stacking ten-foot sections together to provide a mast of any desired height. This special joint insures tight and rigid connections. Constructed of 1¼" o.d. "Perma-Tube" steel, this mast is electrically welded for strength and long life.

Complete details on the mast line are available from the company.

CHECKER-REACTIVATOR

Electronic Beam Corp., 923 Old Nepperhan Avenue, Yonkers 3, New York

has added a cathode-ray tube checker and reactivator to its line.

According to the company, with this portable unit the television technician can check picture tubes without removing them from the TV sets or their

shipping cartons. He can also reactivate the tube without removing it from the set.

The new Model 10 is housed in a cabinet measuring 9" x 6" x 5" and weighs 2½ pounds. It is self-powered and operates from standard 117 volt a.c. lines. As a tube checker the Model 10 can test for shorts, cathode emission, leakage, etc. in cathode-ray tubes.

MASTER TV SYSTEM

Technical Appliance Corporation of Sherburne, N. Y. has introduced a new TV master antenna distribution system which has been designated as the "Super Series 2500."

The new system features an output of 6 volts peak-to-peak and provides a voltage gain of more than 500. This gain results in better fringe-area performance. Proper stability is maintained in output stages so that no distortion is present in the 6 volt peak-to-peak output. Amplifier strips employ 6AK5 tubes with 6AN5 output tubes.

The master chassis provides the power for the amplifier strips. Rectification of the line current is handled by the tube circuit, thus eliminating selenium rectifiers. The amplifier strips mount directly on the master chassis by means of *Jones* plugs. The mixer unit for the transmission of amplified signals into a single transmission line is an integrated part of the master chassis. Two high-strength outputs are provided on the master chassis.

"KINE-LITE"

Vidaire Electronics Mfg. Co. of Lynbrook, New York is currently marketing a picture tube brightener and rejuvenator which has been tradenamed the "Kine-Lite."

The new unit is designed to add increased brightness to any TV picture tube having low emission and may be used on all standard picture tubes having duo-decal bases.

No soldering or other circuit alterations are required to install this unit. A data sheet giving all pertinent data is available. —30—

WANTED!

All TS, APR, APS, ARC, ARN, ART, SCR, R89 and BC equipment . . . write today!

Quote prices in your first letter.

SCR 625 Famous Army Mine-Detector

For Prospectors, Miners, Oil Companies, Plumbers, etc.

This unit is being offered now at a considerable reduction in price. Recently advertised at $79.50 it is now available in the same brand new wrappings in suitcase style carrying case (less batteries) at

$59.50 WHILE THEY LAST! Used, like new, $39.50

Closing Out All TUBES

16JP4	$16.95	304TH	$8.95	805	$2.69	9003	$1.29
16DP4	16.95	304TL	8.95	9001	.99	6AJ5	2.25
14CP4	16.95	830B	1.69	9002	.79	6AC7	.79
4AP10	$1.95						
5CP1	3.95						
5BP4	3.95						

RT7 APN1 TRANSCEIVER UNIT—Used as an altimeter, it may be converted for signaling control circuits, etc. Complete with 14 tubes and dynamotor they are in good used condition at the amazingly low price of . . . $24.95
Used, less tubes, with wobulator . . . 9.95

BC 604 FM Transmitter—20-27 mc. 10 Channel crystal controlled push-button, excellent for conversion to 10 and 11 meters, small quantity on hand, in good used condition, less dynamotor, some missing side covers, etc.—otherwise complete, including tubes . . . **$7.95**
Like new . . . $12.95

	Used	New
BC-453, less tubes	$10.95	.....
BC-454, 3-6 mc receiver, less tubes	5.95	.....
BC-455, 6-9 mc receiver, with tubes	9.95	$14.95
less tubes, as is	5.95	.....
BC-457, 4-513 mc transmitter, less tubes	4.95	.....
BC-458, less tubes, as is	4.95	.....
BC-459, less tubes, as is	10.95	.....
BC-496, 2 position Rec. Control Box	.....	1.95
MC-215 Mechanical Drive Shaft, per length	.....	2.45
BC-450 3 Receiver Remote Control	1.29	2.95
BC-451 Transmitter Control Box	.69	1.50
BC-442 Antenna Relay, less condensers—used	1.29	.....

MONTHLY SPECIAL

RT 34 APS 13 Transceiver used as a tail warning radar on 415 MC. Containing a 30MC IF Strip and various other parts, these units have been stripped of RF sections and all tubes but are an excellent buy if only for parts and IF Strip. Used . . . $4.95

WOBULATOR

See page 43—December "Radio News" **$5.95 ea.**

SURPRISE PACKAGE

20 pounds of assorted radio parts. A real value at . . . $2.45

Shipments FOB warehouse. 20% Deposit on orders. Minimum order $5.00. Illinois residents, add regular sales tax to remittance.

Prices subject to change without notice.

MIKES and HEADSETS

HS-33 Low Impedance Headset, exc. $2.95 new $5.50
CD-307 Ext. cord for HS 23-33 . . . like new 1.29
Throat Mike—T 30 . . . New .98
Lip Mike—Navy Type . . . New .98
Extension Cord and Switch Assembly for lip and throat Mikes . . . New .98
CW 49505 High Impedance headset complete with leather headband and rubber cushions. Used **$1.95**
RS-38, Microphone . . . new $4.95
TS 10 sound powered HAND SET . . . used, ea. 5.95
HS-38 . . . exc. $1.95 new 2.29
HS-30, miniature headset . . . new 2.49, used 1.49
HB-7 Headband, used, exc . . . 1.25

Complete MN26C

200-1750KC, manual directional finder, complete with all parts . . . $79.50

DYNAMOTOR

The best dynamotor for conversion to 6v. Multiple windings! After conversion you get choice of 190 or 350 v at 50 MA or 250 v at 100 MA. No brushes to shift around, no mechanical work. Or use it as a 2:1 or 1:2 step-up or step-down transformer for DC voltage! Changes 6 to 12, or 12 to 24, or vice versa, up to 3A. Or use it as a GENERATOR. Turn with motor, get 12 v DC at 12.6 A or 24 v DC at 6.3 A, plus high voltage. Includes easily removable self-contained 800:1 sealed-in-oil gear reduction unit. Complete dope sheet furnished.
BRAND NEW . . . $4.65

BC 624 receiver (SCR 522), less tubes, used **$19.95**
BC 625 transmitter (SCR 522) less tubes, used **14.95**
SCR 522 transceiver, complete in case with top bracket, less tubes . . . **29.95**
Transceiver — 100-156 mc, 2 meter, used, excellent condition, less dynamotor, with tubes . . . $32.95

WRITE FOR PRICES

BC1033	BC376	SCR510
BC610	BC639	MP10
BC939	BC638	LP21LM
APS13	RA42	TS170
ARN7	RA52	TS34
SCR269F&G	RA62	TS61
SCR619	RTA1B	TS92
JB70	TA2J	BC1277
R70/APS15	CRT3	BC1287

R W ELECTRONICS Dept. N, 1712-14 S. Michigan Ave., Chicago 16, Ill. PHONE: HArrison 7-9374

WANTED . . .

- **TCS-7 and up**
- **SCR 274N, BC 696**
- **SCR 399 Equipment JB 70, JB 60, BC-939A BC-610-E RA-63, EE8, BC-614-E, PE95, PE197, Trailer K-52, Cords, LS-3**

RADCOM pays highest prices for surplus equipment, parts and tubes.

- **SCR-508 . . . BC-604, BC-603, FT-237, Crystal Sets.**
- **SCR-506 . . . BC-653-A, BC-652-A, DM-40-A, FT-253-A, BC-658-A.**
- **BC312, 342, 348 Receivers.**
- **SCR522 Equipment, SCR-211 Freq. Meters. RA-34 Rectifiers.**

Phone Bigelow 2-6666

MANUALS TUBES TEST SETS

Always Right With Earl White

RADCOM Engineering Co. 8 Livingston St. Newark 3, N. J.

TOP QUALITY! LOW COST!

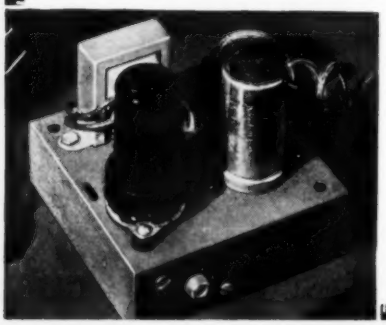
FISHER

HIGH QUALITY

Phonograph Preamplifier

■ Here is the *top* quality, *reasonably priced* preamplifier you have always wanted. The FISHER provides exact equalization for low-level magnetic pickups of *any* make, such as GE, Pickering, Audax, Clarkstan and others; also used as a microphone preamplifier.

List $20.95



Outstanding Features:

Uniform response, 30 to 20,000 cycles. Self powered. Two stages of triode amplification. Extremely low hum.

Full low-frequency equalization. High gain. Completely enclosed chassis with bottom cover. Plugs supplied.

Output cable can be up to *50 feet* in length. SIZE: 3¾ x 3⅝ x 3⅝ high.

WRITE FOR FULL DETAILS

FISHER RADIO CORPORATION
39 E. 47TH ST., NEW YORK

Concertone

MAGNETIC TAPE RECORDERS

NETWORK RECORDER NWR-1

"just like being there"

THE ONLY low cost high fidelity tape recorders delivering professional performance. Professional users' net prices begin at

$345.00

Write for Bulletin #102

Manufactured By

Berlant Associates

4917 W. Jefferson Boulevard
Los Angeles 16, California

STAR SPECIALS

NEWEST ITEMS! LOWEST PRICES!

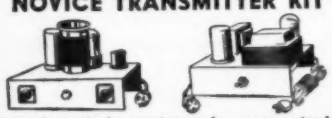
PERMOFLUX REAR DECK SPEAKER KITS

Easy to install; provides greater radio enjoyment in your car. Requires only connection to speaker terminals in auto radio. 3-way wired switch permits speakers to operate separately or together. Complete with metal grille and protective speaker screen, hardware, template, instructions, etc.

$7.94

RS46A 4" x 6" Speaker Kit
RS96J 6" x 9" Speaker Kit $10.29

NOVICE TRANSMITTER KIT



Ideal for beginning amateur or for use as a stand-by rig. Operates on 80 and 11 meters. Big pictorial and schematic diagrams for easy assembly by anyone. Complete with two punched chassis, coil forms and wire, tuning indicator, and all other assembly parts plus standard telegraph key and tubes (6V6, 6L6 and 5Y3GT). Less crystal and small amount of hookup wire and solder required.

Novice Transmitter Kit $32.58

BARGAIN LOW PRICE

FLYBACK TRANSFORMER

(Similar to GE 77J1)

Regular $11.00 list price high voltage transformer similar to General Electric 77J1. Used for general replacement in many sets up to 14KV and with up to 19" tubes. Not available elsewhere at our low price!

A-1827 Flyback Transformer $2.49

COMPLETE STOCKS All Standard Brands

Just off the press BIG BARGAIN BULLETIN

STAR ELECTRONIC DISTRIBUTORS, INC.

Dept. RN-8—7736 S. Halsted, Chicago 20, Ill.

Electronic Growth
(*Continued from page* 39)

casting stations and the motion picture studios in California. In keeping with its credo that a modern electronic parts distributor must be more than a passive vehicle for the supply of parts, the company has sponsored educational meetings for both its industrial and dealer customers. For example, the company recently sponsored an "Image Orthicon Seminar" which was attended by virtually all key television camera technicians located in Southern California.

In addition, the company developed early in 1949 a series of charts and paper invoice forms which dealers could use to break down their charges for the repair of television sets. These invoice forms, which the company printed and sold to its dealers without profit, allowed the dealer to estimate his charges intelligently and to explain to his customers the breakdown of his repair bill at the time when television repair was an uncharted field. These dealers report that these forms have greatly helped them in customer relations and have been responsible for many repeat sales.

Today ten dealer-salesmen regularly cover a territory extending from the Pacific Ocean into Arizona and from Fresno and Paso Robles far into Mexico. Resident salesmen are located in Bakersfield, Santa Barbara, Riverside, and San Diego. The company's export department has been in existence for fourteen years. Five industrial salesmen call regularly on every important industrial account in Southern California and counter salesmen of long-standing amateur status take care of the ham customers.

The design and construction of *Radio Specialties Company's* new home was based on years of experience. Where the average parts distributor displays most of his stock, which consumes from 60 to 100 per-cent of his total area, this firm's store takes up less than 10 per-cent of the total area with the other 90 per-cent being given over to warehousing facilities. No stock is located in the store itself. Only one sample of each basic part is displayed, the small parts being shown on sample boards located along the walls and in specially designed glass-covered islands on the sales floor. Large items which need to be demonstrated, *i.e.*, test and sound equipment, record players and changers, etc., have one sample each located along the walls under the sample boards and under a large mural showing *RCA* products and factory processes. These large units are the only items which can be touched by the customers.

There are no inefficient ladders to climb in either the warehouse or store, all shelves being designed at a height a normal person can reach while standing on the floor. The warehouse has a conveyor system which permits the merchandise to be unloaded and rolled

to the receiving room, checked, and then rolled on into the warehouse without lifting. The merchandise locations have been carefully studied with the result that heavy or bulky items are located either close to the receiving door or immediately adjacent to the conveyor system. Merchandise sold primarily over the counter is located as near the counter as possible while merchandise sold mostly through outside salesmen is located close to the order filling and shipping departments.

The entire new layout and decorative scheme was an attempt to keep pace with the changing emphasis and rapid growth of electronics in a fast-growing area. *Radio Specialties* believes that it has succeeded and that the gamble on the future of the Pacific Southwest's electronics industry was a shrewd one. The industry is sound and the company has invested heavily to prove its point.

-30-

MID-SOUTH AUDIO SHOW

MUSIC lovers and audio enthusiasts in the area around Memphis, Tenn. are looking forward to the "Mid-South Audio Show" to be held at the Peabody Hotel in Memphis August 4th through 7th.

Sponsored by the W & W Distributing Company of Memphis, the show will feature an extensive display of such well-known high fidelity equipment as that made by Jensen, Stromberg-Carlson, Electro-Voice, University, Stephens, McIntosh, Newcomb, Bell, Radio Craftsmen, Meissner, Browning, Ampex, Concertone, Presto, Pentron, Crestwood, Rek-O-Kut, Garrard, V-M, Webster, and others.

Hotel reservations will be made by W & W Distributing Company, P. O. Box 436, for any out-of-town guests planning to attend this event.

-30-

CHECK TUBE OPERATION

By H. LEEPER

TV receivers using a type 1B3 rectifier can be easily checked for operation of this tube by holding a neon bulb near the tube's top cap. If r.f. energy is being delivered to the rectifier tube, the r.f. voltage nearby will cause the neon tube to glow.

While a two-watt neon lamp is shown in the photograph, a smaller (¼ watt) bulb works even better.

Use only one hand when making this check. Keep the other hand away from the chassis and be sure not to contact the rectifier tube cap with the fingers.

-30-

Checking the 1B3 rectifier in a TV set.

Sensational TUBE SAVINGS

80% to 90% off list!

UNBEATABLE! UNPRECEDENTED!

Tried and true performance plus economical service make these low, low priced, high quality, fully guaranteed tubes the sensation of the nation. Every tube rigidly tested, every tube a standout value.

All Tubes Individually Boxed! Same Day Service!

Check this list for Fully Guaranteed Tubes

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
OB3 VR90	.75	3Q5GT	.49	6BC5	.44	65Q7GT	.37	125K7GT	.48
1A5GT	.46	3S4	.46	6BC7	.70	6T8	.56	125L7GT	.47
1A6G	.59	3V4	.47	6BD3GT	.59	6U5	.44	125N7GT	.52
1A7GT	.47	5AX4	.37	6BD6	.45	6U8	.61	125R7	.49
1AB5	.59	5AZ4	.39	6BE6	.39	6V3	1.10	14A7	.44
1B5	.59	5U4G	.40	6BF5	.41	6V6GT	.39	14AF7	.53
1B7GT	.59	5V4	.73	6BF6	.37	6W4GT	.44	1486	.40
1C5GT	.43	5V4G	.54	6BG6G	.94	6W6GT	.44	14J7	.60
1G6	.60	5X4	.40	6BH6	.46	6X4	.37	14W7	.60
1H5GT	.40	5Y3GT	.32	6BJ6	.39	6X5GT	.37	19BG6G	.95
1L4	.46	5Y3G	.32	6BL7	.59	6Y6G	.48	19C8	.80
1L6	.43	5Y4G	.35	6BQ6GT	.59	7A4	.47	19T8	.79
1LC5	.51	5Z3	.39	6BQ7GT	.72	7A7	.48	19V8	.97
1LC6	.48	6A3	.59	6C4	.37	7A8	.46	25BQ6GT	.62
1LN5	.51	6A7	.59	6C5GT	.39	7AF7	.53	25L6GT	.39
1N5	.46	6AB4	.44	6CB6	.44	7B4	.44	25W4	.56
1P5	.57	6AG5	.43	6CD6G	1.11	7C6	.40	25Z5	.40
1Q5	.61	6AJ5	.90	6E5	.48	7E6	.49	25Z6GT	.37
1R5	.45	6AK5	.75	6F5GT	.39	7F7	.59	32L7	.85
1S5	.39	6AL5	.38	6F6	.37	7N7	.50	35B5	.40
1T4	.45	6AQ5	.39	6G6G	.52	7X7	.69	35C5	.39
1T5	.53	6AQ6	.37	6H6GT	.41	12AL5	.37	35L6GT	.41
1U4	.45	6AR5	.37	6J5GT	.37	12AT6	.37	35W4	.37
1U5	.39	6AS5	.50	6J6	.52	12AT7	.56	35Z4	.39
1X2	.63	6AT6	.37	6J7G	.43	12AU6	.38	35Z5GT	.37
2A3	.70	6AU6	.38	6K6GT	.37	12AU7	.43	36	.60
2A5	.47	6AV6	.37	6K7	.44	12AV6	.39	42	.42
2X2	.59	6AX4	.53	6L6	.64	12AV7	.59	45	.55
3A4	.45	6B4G	.64	6L6G	.64	12AX4	.48	50B5	.39
3E5	.46	6B5	.64	6Q7	.45	12AX7	.48	50C5	.39
3Q4	.48	6BA6	.39	6S4	.38	12AZ7	.68	50C6	.39
		6BA7	.37	6S8	.53	12BA6	.38	50L6GT	.41
				6SA7GT	.43	12BA7	.46	50Y6	.46
				6SD7GT	.41	12BE6	.39	50Y7	.50
				6SG7GT	.41	12BH7	.63	70L7GT	1.09
				6SH7	.73	12K7GT	.46	75	.41
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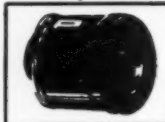

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Technical BOOKS

"DESIGN AND CONSTRUCTION OF A WHEATSTONE BRIDGE" prepared and published by *Technological Developments,* 475 Fifth Avenue, New York, N. Y. 6 pages. Price $1.00. Paper bound.

This 6-page booklet contains complete construction and design information on a Wheatstone Bridge. The function of the bridge is explained in some detail including the necessary mathematical computations. The author has also outlined the various points which must be considered when such a unit is to be designed.

The balance of the text covers the actual construction of the instrument and explains how various measurements can be made with the unit. The text is illustrated with large, clear diagrams which can be used in constructing the bridge.

* * *

"20 BASIC POINTS FOR TV RECEIVER SERVICE" by A. C. W. Saunders. Published by *Paul H. Wendel Publishing Co., Inc.,* Indianapolis. Fifth "Notebook" in the Television Technicians Lecture Bureau series. 44 pages. Price $1.00. Paper bound.

This new technician's notebook covers twenty of the basic parts of a television receiver which can be used as the basis of a troubleshooting and servicing system.

The author's servicing technique, as developed in the text, involves the statement of twenty fundamental principles and then the detailed explanation and amplification of the "theorem." Using this method, the author deals with such subjects as the design of video amplifiers for broadband response, control of stage gain, the function of a.g.c., tuned circuit response, gain and bandwidth comparison, stagger tuning of i.f. stages, parallel effect of the grid circuit on the plate load, design requirements of video detectors, the phase inversion properties of a conventional amplifier, etc.

As with most of Mr. Saunders' lectures, the text is written in a down-to-earth style omitting extraneous material. Technicians who have worked with the "Notebooks" in the past will find this newest release up to standard.

* * *

"AUDELS TELEVISION SERVICE MANUAL" by Edwin P. Anderson. Published by *Theo. Audel & Co., Publishers,* New York. 384 pages. Price $2.00.

This compact, pocket-size handbook is a practical how-to-do-it presentation of television receiver installation and servicing.

The book contains eighteen chapters dealing with the placement of the TV receiver, test patterns and adjustments, TVI, interference traps, television antennas and transmission lines, master antenna systems, installation procedures, broadcasting, receiver circuit fundamentals, typical receiver circuits, picture tubes, projection receivers, TV test equipment, servicing, troubleshooting, waveform analysis, color television, and color conversion methods. A separate chapter carries a television glossary.

The text material is lavishly illustrated with line drawings, circuit diagrams, and photographs which serve to amplify and supplement the author's explanation of the principles involved. The book is written clearly and without resorting to involved mathematics or complicated calculations.

The book should meet the requirements of the budding television technician very handily.

* * *

"PRIMER OF ELECTRONICS AND RADIANT ENERGY" by Don Caverly. Published by *McGraw-Hill Book Company, Inc.,* New York. 334 pages. Price $5.50. Second Edition.

This is a layman's book designed to make the subject of electronics understandable to persons without technical training in that field.

The author has attained the often-impossible goal of presenting a potentially-complex subject in a thoroughly lucid style. Without condescension or purposely "talking down" to his audience, the writer has presented a quantity of interesting data covering a wide range of topics.

The book itself is divided into four parts dealing with electricity, magnetism, electromagnetic radiation, and electron tubes and sources of radiant energy. Each of these main headings is subdivided into chapters which cover the major aspects of the primary topic.

By using familiar analogies and a large number of diagrams and photographs to amplify the text material, the author has provided the reader with at least an intelligent speaking acquaintance with many of the man-made marvels of this century.

* * *

"TEST INSTRUMENT APPLICATIONS MANUAL" by Edward M. Noll. Published by *Paul H. Wendel Publishing Co., Inc.,* Indianapolis. Sixth "Notebook" in the Television Technicians Lecture Bureau series. 48 pages. Price $1.00. Paper bound.

The practical application of various types of television test equipment is the subject of this information-packed booklet which has been prepared especially for the service technician.

The text material is divided into three main sections covering the features and characteristics of various types of TV test gear, how to know your test equipment, and how to use it. The use of the test equipment is clearly explained by means of specific examples and service-tested procedures.

The equipment covered includes such instruments as oscilloscopes, sweep oscillators, v.t.v.m.'s, instrument probes, and signal generators. Diode modulators, u.h.f. test equipment, and service bench arrangements are also considered in some detail. —30—

Servicing Picture Tubes

(*Continued from page 37*)

Note 2: Some customers have been concerned over a luminous "flashing" which occurs for some time after the set is turned off. This trouble will not harm the screen. If it is bothersome to the customer, try readjusting the ion trap slightly or try the high-voltage bleeder resistor just described.

5. *DEFECT: Picture either washed-out or extremely "contrasty" (Fig. 3 or 4); brightness control will not affect brightness.*

CAUSE: Grid-cathode or heater-cathode short in picture tube. (In certain models, a shorted or leaky condenser in the brightness control circuit will cause the same trouble.)

REMEDY 1: If the tube is within warranty, contact the dealer or distributor for replacement.

REMEDY 2: Try burning out the short by applying a.c., d.c., or r.f. across the shorted elements. The author has found that r.f. voltage obtained from an amateur transmitter, high voltage power supply of the TV receiver, or a similar source of low-current, high-potential is much more effective in clearing shorted elements (in any tube) than either 117 volts a.c. or 117 volts d.c. The apparent reason is that most shorts of this type are not caused by direct contact between sagging or displaced elements, but rather from dislodged particles of the emitting surface. The application of r.f. tends to burn out or anneal these particles so that they cause no further trouble. (A number of such tests by the author have been entirely satisfactory.)

REMEDY 3: If the above method will not clear the short, *isolate the* shorted element by installing a separate filament transformer for the picture tube. (Any small, inexpensive transformer which will handle the picture tube's heater voltage and current requirements will do.) Tie the cathode to one of the heater terminals but *do not* ground the transformer secondary or center-tap. (Isolating the cathode circuit in this manner allows the brightness control to function normally and in many cases will actually improve picture quality by reducing transient and line noise effects.)

Note 1: The above method obviously will not work in receivers which feed the video signal in through the cathode instead of the grid, or in tubes which have a cathode-grid short. Burning out the short or replacing the tube are the only solutions here.

Note 2: The effect shown in Fig. 3 can also be due to a weak or low-emission picture tube. In this case, however, the brightness control will function normally. Substitution will prove this condition.

6. *DEFECT: Magnetized picture tube (Fig. 5 or 6).*

CAUSE: Metal-cone picture tubes (16EP4, 19AP4, etc.) can become mag-

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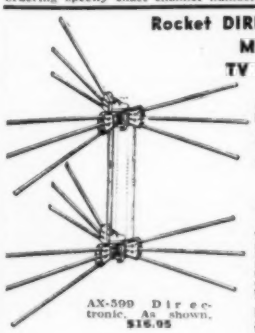

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AX-59 Directronic, 9 element Single..... **10.35**

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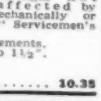

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netized if they are operated near a PM speaker or other strongly-magnetized object.

REMEDY: Remove the chassis and move a small pocket compass over the metal cone. The affected area will usually be sufficiently magnetized to give an indication on the compass. Then *de-magnetize the affected area* by holding an a.c.-energized coil over the picture-tube cone for a minute or so. (An old focus coil will serve if suitable series resistance is used to prevent its overheating when used on 117 volts a.c. If you prefer, you can make your own coil by winding 1300 to 1400 turns of #24 cotton-covered wire on a form 6" in diameter and 3" to 4" in length. A piece of linoleum rug core, cardboard jelly container, etc., will do.) Hold the coil endways over the magnetized area for a minute or two. When you remove the coil, keep it energized until away from the tube; otherwise, magnetization may again occur. The distorted raster edges should straighten when the cone has been thoroughly demagnetized.

7. *DEFECT: Hum in picture; curved or distorted raster edges similar to Fig. 7 or 8.*

CAUSE: In some cases due to internal damage (caused by dropping, excessive vibration, etc.).

REMEDY: Try substituting a new picture tube before checking for troubles in out-of-the-way places in the high or low-voltage supply. (Experience will indicate whether a defective filter, tube, etc., is most likely.)

8. *DEFECT: Picture inverts or goes negative when brightness control is advanced (Fig. 9).*

CAUSE: Defective picture tube; weak high-voltage rectifier tube; defective video i.f. or r.f. tube; weak or misadjusted ion trap magnet.

REMEDY: Check tubes listed above. Before trying picture tube, try adjusting ion trap or replace it with a new one.

Correcting the foregoing troubles will be left mainly in your hands. The customer, however, can help extend the life of his picture tube by following these four basic suggestions:

(1) *Never turn the brightness full on for any length of time.* In large tubes (*i.e.,* 20 to 30-inch), only a few seconds at full brilliance can cause permanent damage to the screen coating, especially if the ion trap is not properly adjusted.

(2) *Make sure the ion trap magnet (if your set has one) is properly adjusted.* (Check with your technician or dealer if you are not sure about this).

(3) *For daytime viewing, keep the set away from direct sunlight.* If it is located near a window, draw the blinds or shades at least half-way. (The more unnecessary light in the room, the higher you will have to set the brightness control to get a satisfactory picture. *Excessive brightness will reduce the life of your picture tube.*

(4) *Don't leave the set on while you visit with neighbors.* If you leave the room to answer the phone, doorbell, etc., or if you listen to the sound only when preparing lunch or dinner, turn the brightness down. This will prevent damage to the screen if one of the sweep tubes should fail. If you are near the set, you will be able to turn it off if this occurs. (Sweep failure will leave a bright, thin horizontal line if the trouble is in the vertical circuit; some sets will have a bright vertical line if horizontal sweep fails, while others will lose screen brilliance entirely if this occurs).

You can do your customers a favor and improve picture quality of their older-model receivers by replacing type 10BP4 and 12LP4 tubes with 10FP4 and 12KP4's, respectively. These aluminum-backed types will increase both brilliance and contrast. Since neither requires an ion trap magnet, discard the old trap or, if coils are used, simply tape them out of the way on the chassis.

–30–

Mac's Service Shop

(*Continued from page* 60)

obstetrician and the general practitioner: one brings the babies into the world, and the other keeps them in it; and who dares say which has the more important job?

"You know it's a kinda funny thing, but almost every technician has a favorite story about a case in which a design engineer tried his hand at servicing and was a miserable flop; yet nine out of ten of us secretly fancy that we could give the engineering boys some pretty sharp suggestions about their job if we were just a mind to."

"Well, you're not talking to me," Barney said as he turned back to the little set on the bench. "I'm about ready to admit that I'm a complete idiot who knows nothing about either design or service. I've spent a half a day on this stinker and have not helped it a bit."

"What's the beef?"

"It picks up ignition noise. Noise from a car as much as a block away will ride right in over a broadcast station as though you were listening on ten meters. In every other way the set is normal. Sensitivity and selectivity are good. All voltages check right on the nose. I've put in a whole new set of tubes."

"Did you use the signal tracer to see where the noise seems to begin?"

"Yes, I can first hear it on the grid of the i.f. tube. That makes me think it starts in the 12SA7 mixer. Of course the oscillator rush drowns out everything else on the plate of that tube."

"Got any theories?"

"None that seem to lead anywhere. I keep wondering how the set could be receiving a broadcast station on around a thousand kilocycles and at the same time be sensitive to ignition noise that likely peaks up around fifty megacycles."

"Try putting a resistor of about 1000 ohms in the lead from the oscillator grid to the oscillator tank circuit," Mac suggested.

Barney's diagonal cutters were at work almost as soon as Mac finished speaking, and the resistor was clipped in place. A pleased grin spread over Barney's freckled face as he tuned across the band without hearing any sound from the cars that were passing up and down in front of the shop.

"Give!" he commanded his boss.

"Well I'll confess that I did not just whip up the answer to that one right now," Mac said. "I sweated over just such a problem for a whole day before getting the answer. The trouble is a parasitic oscillation in the oscillator grid circuit that peaks up somewhere around thirty megacycles. The ignition noise mixes with this high frequency oscillation and goes right on through the i.f. system along with the signal produced by the beat between the regular oscillator and the broadcast station. That resistor simply serves as a parasitic suppressor."

"Well I'm certainly glad that is out of the way," Barney commented. "Now I can get started on putting a new power transformer in that console."

"Are you sure it needs a new transformer?"

"Can't you tell by the smell?"

"I can tell the transformer has been overheated, but that does not always call for a new transformer. Those jobs will often take a lot of punishment. Pull the rectifier and check the voltages of the two filament windings. If both are normal, let the set run for a few minutes with the rectifier out of the socket. Listen carefully for any frying sounds coming out of the transformer and notice if it heats up. If either of these symptoms is present, you are safe in telling the customer he will have to have a new transformer; but if it runs cool and makes no noise, find out why it got hot before.

"Usually you will find a short in the "B-plus" circuit that is causing a heavy overload on the transformer when the rectifier is in its socket. Cathode type rectifiers often develop cathode-to-plate shorts that cause transformers to overheat quickly. Filament leads sometimes become shorted, especially around dial lamp sockets or where a 'hot' filament lead passes around a sharp-edged chassis projection or right where these leads issue from the hole in the transformer shell. That is why I wanted you to check for low filament voltages, indicating a possible short, before letting the set run.

"Once the cause of the overloading has been located and removed, put the rectifier back in the socket and let the set run for at least a couple of hours, noting carefully if the transformer overheats. Remember that most transformers eventually reach a temperature where the hand can barely stand the heat. If everything seems normal, do not replace the transformer. It may not hold up, but the odds are that it will."

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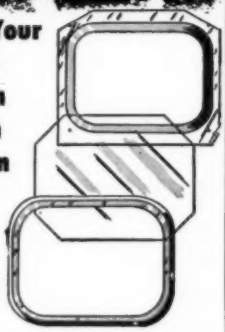

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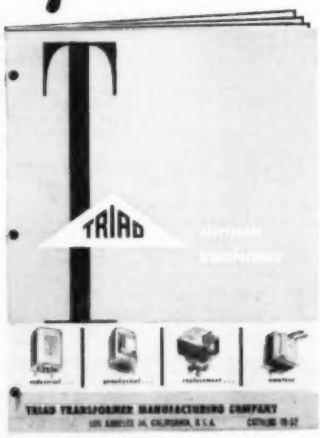

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"The hot, humid weather is an important factor. When the surrounding air is around ninety degrees, the transformer has more difficulty in getting rid of the heat generated inside itself. Then, too, lightning often comes in over the power line, even jumping an open switch, and breaks down the insulation between adjoining turns. Once a transformer has shorted turns, it will heat up rapidly with or without external load and must be replaced.

"Whether you put in a new transformer or not, be sure and clean off any of the sticky mess that runs out of a hot transformer onto the chassis and cabinet. If you don't, a strong, pungent odor will be given off by the set as soon as it gets warm, and this may last for weeks.

"If you do have to replace the transformer, do your durndest to get one with the exact voltage windings as the original and also with the identical current ratings or just a little higher. Do not go all out on the 'safety factor' and try to use a transformer with much heavier current ratings than will be needed, for this will mean that voltages in the set and cost to the customer will both be higher than necessary. Always fuse the primary of a new transformer. A two-ampere fuse is about right for consoles, and a three-amp fuse will carry most TV sets. Putting in this fuse is just good insurance on your service job. A new transformer is a pretty costly affair to the customer, and he is going to be very unhappy if he has to repeat the operation as long as he has the set. I often drill a nest of half-inch holes in the cabinet shelf directly beneath the transformer to give it added ventilation—"

"Can't we talk about a cooler subject," Barney broke in plaintively, as he wiped the sweat from his forehead with his handkerchief.

—30—

PROTECT CORD TIPS

By ARTHUR TRAUFFER

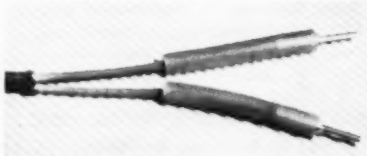
TO PROTECT my phone cords which are continually bending at the tips, I slip 2" lengths of small diameter rubber tubing over the tips and cords as shown in the photo.

Natural rubber tubing, about ¼"o.d. and ⅛" i.d., such as sold in hospital and medical supply stores or by chemical supply houses, is ideal for this purpose.

The rubber covering for the tips reduces body capacity effects when using the tips in experimental circuits.

—30—

Protect phone cord tips with rubber tubing.



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Improved Speech Clipper

(*Continued from page 57*)

a suitable contrast between the pilot lamp and the flashing neon lamps.

The filter condenser cans containing C_{20} and C_{21} should be mounted on insulating plates and all ground connections for the power supply components made with insulated wire and connected at one point only to the chassis. Shielded wire should be used between J_1, J_2, J_3, J_5, grid of V_4, S_1 and their associated connections in the circuit. No trouble will be experienced if the normal precautions for the construction of a high-gain audio amplifier are taken.

The component layout may be seen from the photographs and it is suggested that this layout be followed if possible. In Fig. 3, V_1, V_2, and V_3 are mounted in line along the front edge of the chassis with V_1 near the clipping level control, and CH_2 near the output level control. V_4 and V_5 are located in line between CH_2 and T_2. The calibration control, R_{24}, is mounted through the top of the chassis between V_5 and V_7. J_2 is mounted next to V_1 near the top edge of the chassis, and J_4 is mounted on the opposite chassis-end near CH_2. The hum-balance and bias controls, R_{14} and R_{15}, are mounted on the rear chassis drop, along with J_1, J_5, the fuse holder, and the a.c. receptacle. Tube shields should be used on V_1, V_2, V_3, and V_4.

The entire unit is constructed on an aluminum chassis, 9 x 7 x 2 inches. The aluminum panel was cut to 10¾ x 6½ inches to fit a small cabinet that was on hand.

Calibration and Operation

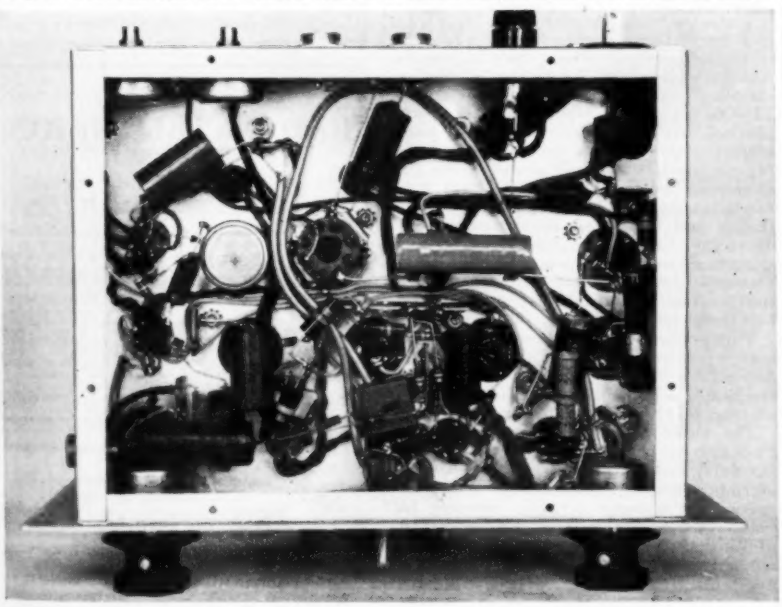
Connect a sine-wave signal source of about 30 millivolts to J_1 and a vacuum tube audio-frequency voltmeter to the reference signal jack, J_2. Connect the vertical input of an oscilloscope from J_3 to ground.* Increase the setting of R_6 until the scope pattern shows that the sine-wave peaks are just starting to be clipped. Note the value of signal voltage at J_2. (It was 30 millivolts in the unit described here.) Now increase the setting of R_6 until 1.3 times the previous voltage reading is obtained at J_2. The waveform at J_3 will show that clipping is now taking place. Reduce the setting of R_{24} to minimum, and increase R_{13} until the neon lamps are lighted. Slowly reduce the R_{13} setting until all of the lamps are completely extinguished. This procedure is necessary because the gas-filled neon lamps, once lighted, will not be extinguished until the bias voltage is reduced several volts below the ignition voltage. Now increase R_{24} just enough to cause the 2 db lamp to light, and the calibration is complete.

Before the unit is calibrated it might be well to test the operation of the neon lamps to eliminate the possibility of one or more being defective. This may easily be accomplished by varying the bias control R_{13}. The lamps should all light within two volts of each other. Any which do not operate within this range should be replaced to avoid errors in calibration.

After connecting to the regular microphone and speech amplifier, switch the clipper out of the circuit and adjust the gain control on the regular speech amplifier for 100 per-cent modulation. Set the clipper output level control to zero and increase the clipping level control so that the desired amount of clipping is obtained as indicated by the flashing lamps. Switch

* If necessary test equipment is lacking, the unit may be calibrated in a short time at nearly any local radio service shop.

Fig. 5. Under chassis view. Ample room is available despite small over-all size of unit.



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MFD	VDC	Price	MFD	VDC	Price
.001	600	$.18	.024	1500	$0.65
.002	600	.24	.033	1500	.75
.01	600	.26	.02	2 KV	.90
.02	600	.26	.005	2500	.55
.01	1 KV	.45	.002	2500	.45
.002	1200	.35	.0001	5 KV	.70

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10 watt ohms: 25-40-1325-2K-4K ..... .15 ea.
20 watt ohms: 150-300-750-1K-1.5K, 2.5K-2.7K-10K-20K ..... .20 ea.
30 watt ohms: 100-2500-5300-18K ..... .22 ea.

ADJUSTABLE SLIDER RESISTORS
20 Watt: 1, 5, 300 ohms $0.25
75 Watt: 100, 150, 200 ohms ..... .39

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the clipper back into the circuit and advance the output level until 100 percent modulation is obtained. The clipper may now be switched in or out at will with no further adjustment of controls necessary. The clipping level may be varied at will from no clipping at all to the maximum available, with no adjustment of output level required, since the output voltage cannot exceed the value previously set.

The regular speech amplifier and modulator should be modified to improve the bass response as much as possible. The aim should be to improve the over-all response of the system to a square-wave signal and to eliminate as much phase shift as possible. The reader may refer to standard reference sources to ascertain what course of action is indicated for his particular circuit conditions.

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4. Technical Topics; "Some Facts of Modulation," QST, March, 1951.

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-30-

MORE TV LINKS

THE Long Lines Department of American Telephone and Telegraph Company has several projects underway which will eventually provide additional television facilities for various sections of the country.

Work has already started on laying coaxial cable between Little Rock and Memphis. When completed, the cable will handle hundreds of telephone conversations simultaneously and provide the basic facilities required for TV service when Little Rock is to be connected into the nationwide television network.

The company has also made application for authority to construct a microwave radio-relay system from Dallas to Austin where it will connect with the existing Austin-San Antonio system. The new system, scheduled for completion late this year, will make possible the addition of hundreds of telephone circuits and will provide two TV channels between Dallas and San Antonio. Along the 192 mile route between Dallas and Austin six intermediate radio-relay stations will be built to beam signals from one tower to the next. The tapered steel towers on which the Bell System antennas will be mounted will range in height from 162 to 325 feet.

Temporary radio-relay equipment, which was installed between Dallas and Austin for the national political conventions, will be removed upon completion of the new system.

The third project is the addition of Phoenix, Arizona to the Bell System intercity television network. Television signals are to be routed from Los Angeles over a coaxial cable, already in service for telephone use. The addition of Phoenix to the nationwide TV network makes live network programs available to 107 stations in 65 cities.

-30-

CONDENSERS

Figure 1

Mfd.	2000 V.	Each	Mfd.	5000 V.	Each
.005		$0.85	.001		$1.95
.007		.85	.002		1.95
.00003		.85	.0025		1.95
	2500 V.		.0002		1.95
.0015		.95	.0008		1.95
.00025		.95	.00082		1.95
.0006		.95	.000035		1.95

Mfd.	3000 V. Each	Mfd.	Each
.003	$1.65	.00062	$1.65
.004	1.65	.0005	1.65
.005	1.65	.00009	1.65
.00015	1.65	.000091	1.65
.0003	1.65		

Figure 2

Mfd.	1200 V.	Each	Mfd.	2500 V.	Each
.01		$0.70	.01		$0.90
.02		.70	.015		.90
.001		.70	.001		.90
.002		.70	.002		.90
.005		.70	.003		.90
.0062		.70	.004		.90
.0001		.70	.005		.90
.0005		.70	.00015		.90

Mfd.	600 V. Each	Mfd.	Each
.01	$0.60	.0001	$0.60
.001	.60	.0002	.60
.0025	.60	.0005	.60
.005	.60		

Figure 3

Mfd.	600 V.	Each	Mfd.	1200 V.	Each
.01		$0.35	.01		$0.60
.02		.35	.004		.60
.03		.35	.006		.60
.015		.35	.0022		.60
.001		.35	.00003		.60
.002		.35	.00008		.60
.004		.35	Mfd.	2500 V.	Each
.009		.35	.01		$0.90
.0002		.35	.002		.90
.00005		.35	.0015		.90

Figure 4

Mfd.		Terminal Loc.	Each
4	50V	1s,2s	$0.50
30	150V	2s	.50
1	200V	2s,1s	.50

Figure 5

Mfd.	WV	Terminal Loc.	Each
.5	200	2s	$0.50
2X.5	100	3t	.50
2X.1	400	3t,3s	.60
3X.1	400	3s,3t	.60
.25	400	2s	.60
.35	400	1b	.60
.5	400	2b,2s,1t	.60
.025	600	2t	.70
.1	600	2s,2t	.70
2X.1	600	3b	.70
3X.1	600	3t	.70
1	600	3t	.70
2	600	2s	.70

Oil Filled Condensers

Mfd.	Volts	Price	Mfd.	Volts	Price
.2	600	$0.99	12	2500	$9.95
.4	600	1.89	1	3600	3.95
10	600	3.29	3X.2	4000	7.95
1	1000	.90	1	4000	4.95
1	1200	.98	3	4000	8.95
1	1500	1.79	*2	7500	19.95
.5	2500	1.49	2X.15	8000	1.95
2	2500	3.95	.05	15,000	8.95

*Oil impregnated paper

Micas Figure 6

Mfd.	Volts	Mfd.	Volts	Price
.01	1000	.02	3000	
.025	1000	.00015	5000	WRITE
.04	1000	.0002	5000	
.08	1500	.00009	6000	FOR
.09	1500	.0002	10,000	
.03	2000	*.001	25,000	PRICES

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Microwaves for "Hams"

(*Continued from page 34*)

justment of the wave guide system.

Propagating Characteristics

The statement or belief that microwaves can only be used within the unobstructed horizon is completely erroneous. Such ideas were also prevalent before the amateurs opened up the short-wave band in 1922 and when "five-meter" radio opened up in 1932. Skepticism was rampant when police two-way radio began expanding on v.h.f. around 1935 and when radar on microwaves moved up into the 200 mc. region and above in 1940-41. In every case, equipment has operated beyond the horizon, with many instances having been recorded showing transmissions of several thousands of miles. Once this fact was established, our research experts were able to lay out study programs for yielding an explanation as to how this could occur. New and relevant factors became known. On short-waves, it was the Kennelly-Heaviside layer, first believed to be a single layer and later found to consist of several layers — each of which was responsible for a new set of radio communications ranges. On very-high frequencies, it was the dispersion effect at the horizon plus natural wave guide paths resulting from walls of buildings, sides of hills or mountains, walls of a canyon, or boundaries set by wayside wires and fences, etc.

On microwaves, the possible range of operations is unlimited if the following conditions affecting propagation through space are recognized.

1. *Direct path communication within the unobstructed horizon.* This is approximately equal (in miles) to 1.41 times the square root of the antenna height (in feet) above the intervening terrain *plus* the same conditions for the second station. For example:

Station 1		Station 2
2300 ft.	Height above intervening terrain	0 ft. (sea level)
200 ft.	Antenna height	9 ft.
2500 ft.	Total effective height	9 ft.

Station 1 has a radio horizon of 1.41 $\sqrt{2500} = 1.41 \times 50$ or 70.5 miles while Station 2 has a radio horizon of 1.41 $\sqrt{9} = 1.41 \times 3$ or 4.23 miles. The two stations can thus intercommunicate over a distance of 74.73 miles by direct path.

2. *Indirect path or reflected communication.* This type of transmission may exist either within the horizon, beyond the horizon, or by a reflection within the horizon passing the energy on to another reflecting or pickup point beyond the horizon of the originating station. To understand how this happens, one should consider the source signal as a beam of light and every solid object encountered enroute as a reflecting mirror. Whatever a mirror of such shape would do

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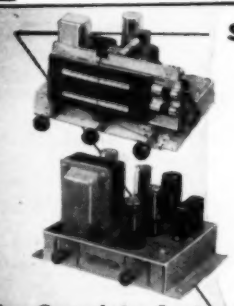

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to light, a similar thing will happen with respect to microwaves. Reflections will be more effective when obstructions enroute are substantially larger than the wavelength. This is quite likely to happen since microwaves are normally less than one foot long. Even dense cloud formations have reflective possibilities. At their greatest height, they can develop great ranges, even for stations operating at sea level with very small unobstructed horizon.

3. *Wave guide paths.* Microwave energy may recognize the space between two wires as the equivalent of the two walls of a wave guide pipe. It will treat one wire as if it were the ionosphere, and the other the earth, and try to propagate sky-wave fashion between such boundaries. The limit of such a communications range is the limit of the availability and existence of suitable wire arrangements around the country. Even the space between railroad tracks can serve as a wave guide, as can tunnels, underpasses, canyons, gorges, etc.

4. *Atmospheric ducts.* These are a function of weather and can make microwaves a tremendously valuable tool in weather forecasting. Microwave propagation at great distances can be tied in with weather conditions. Microwave energy recognizes the boundaries of a stratification of temperature or pressure aloft as a wave guide. It also considers the adjacent boundaries of two strata a wave guide. If signal energy from a transmitter can enter one of these atmospheric ducts or wave guides, the range of communication can become very great—often up to thousands of miles. This fact has been verified on many occasions and is undergoing continuing research by governmental and subsidized institutions. In investigations of this type the hams will be invaluable because of their large groups, geographical distribution, and the number of hours they spend on the air. The phenomenon is often missed by the professional groups working the modern 40-hour week.

Although thousands of persons are currently employed in the microwave industry involving the expenditure of billions of dollars, very few of these persons and only a small portion of the total funds are actually used for propagation studies. Instead, most of the time and money has gone into the design and construction of complex and expensive radar and microwave relay systems.

The author feels confident that when the hams really get into microwaves in sufficient number, the "CQ" call will yield just as interesting responses as those enjoyed now. Microwaves also offer infinite possibilities for a ham organization like the ARRL to live up to its name. Microwaves are an excellent medium for radio relaying and for working out communications networks with a wide selection of echelons to communicate during emergencies and civil defense operations.

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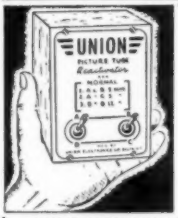

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To utilize the microwave frequencies, the radio ham has to become more of a mechanic than an electrician. He must get used to pipes called wave guides and metallic structures having certain shapes, configurations, and dimensions. He will use "cut-and-try" methods and simple arithmetic in his computations. He will be required to perform simple sheet metal and machining operations in building his apparatus but will probably purchase certain of his gear such as the wave guide probes and coaxial connectors, if they are readily available, otherwise he will build or improvise them from whatever is at hand. There is not one single thing connected with microwave operation on the ham bands that cannot be built or improvised very cheaply if the ham is willing to experiment. Microwaves offer a real challenge to the alert ham—a challenge very few hams will be able to resist!

-30-

MIXER/MASTER CONTROL

By OLIVER BERLINER

OFTEN in the design of audio mixing equipment there is not enough space on the front panel to include a master gain control, or if a master gain is absolutely necessary, one of the mixer positions must be sacrificed or the panel parts layout becomes crowded and/or inefficient.

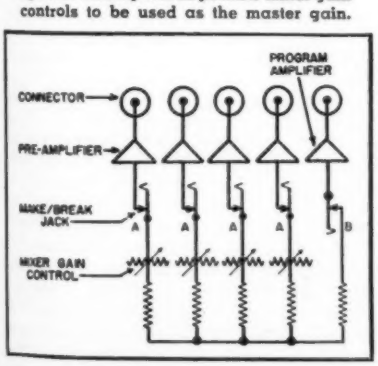
Here is a single-wire block diagram of a mixer circuit designed for larger consolettes but which can be adapted to portable mixers. With this circuit, each and every one of the mixer gain controls can be used temporarily or permanently as the master gain control. In addition, the master gain control can, at any time, be eliminated and all mixers become gain controls, thus increasing the number of inputs by one.

As can be seen from the diagram, by patching any one of the "normalled" A jacks to the "normalled" B jack, that particular gain control becomes the "Master Gain." Removing the patch will return the associated jacks to their normal positions and all the controls again become separate input gain controls.

This system works equally well with both high and low impedance circuits.

-30-

Special hookup which permits mixer gain controls to be used as the master gain.



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The circuit is similar to the one published in Audio Engineering Magazine for November, 1949, and is considered by engineers throughout the audio field as one of the best ever developed. The Main Amplifier (which may be purchased separately) consists of a voltage amplifier and phase splitter using a 6SN7, a driver stage using a 6SN7, and a push-pull output stage using a pair of 807 tubes. The output transformer is manufactured by the Peerless Division of Altec Lansing, and is built to their highest standards. Output impedances of 4, 8, and 16 ohms are available. The power supply uses a separate chassis with husky Chicago Transformer power transformer and choke, and 700V Mallory filters for long hum-free operation. A 5V4G rectifier is used.

The main amplifier and power supply are each on a chassis measuring 7" high by 5½" wide by 11" long.

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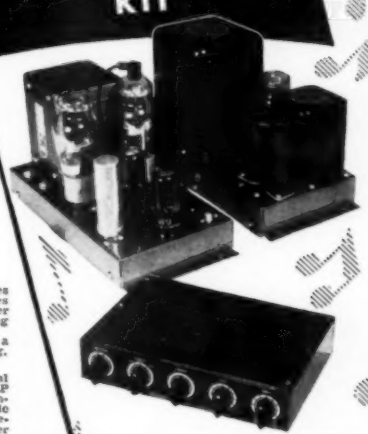
Heathkit AMPLIFIER KIT



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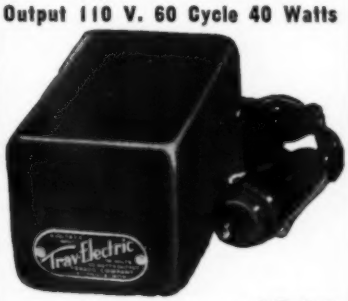

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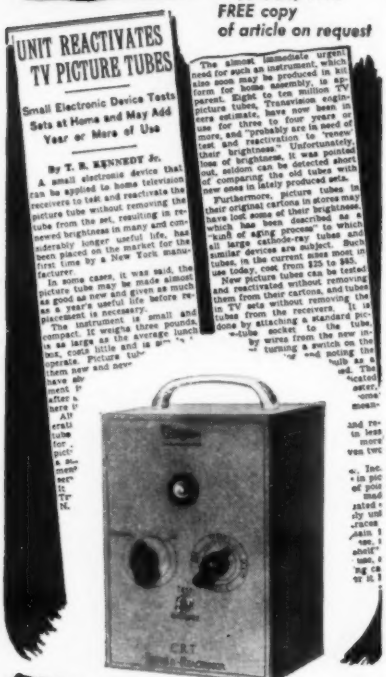
UNIT REACTIVATES TV PICTURE TUBES

Small Electronic Device Tests Sets at Home and May Add Year or More of Use

By T. R. KENNEDY Jr.

A small electronic device that can be applied to home television receivers to test and reactivate the picture tube without removing the tube from the set, resulting in renewed brightness in many and considerably longer useful life, has been placed on the market for the first time by a New York manufacturer.

In some cases, it was said, the picture tube may be made almost as good as new and given as much as a year's useful life before replacement is necessary.

The instrument is small and compact. It weighs three pounds, is as large as the average lunch box, costs little and is

The almost immediate urgent need for such an instrument, which also soon may be produced in kit form for home assembly, is apparent. Eight to ten million TV picture tubes, Transvision engineers estimate, have now been in use for three to four years or more, and "probably are in need of test and reactivation to 'renew their brightness.' Unfortunately, loss of brightness, it was pointed out, seldom can be detected short of comparing the old tubes with new ones in lately produced sets.

Furthermore, picture tubes in their original cartons in stores may have lost some of their brightness, which has been described as a "kind of aging process" to which all large cathode-ray tubes and similar devices are subject. Such tubes, in the current sales most in use today, cost from $25 to $45.

New picture tubes can be tested and reactivated without removing them from their cartons, and tubes in TV sets without removing the tubes from the receivers. It is done by attaching a standard pic- -tube socket to the by wires from the new in- turning a switch on the

TRANSVISION CR TUBE TESTER - REACTIVATOR

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RADIO-TV Service Industry News

AS REPORTED BY THE
TELEVISION TECHNICIANS LECTURE BUREAU

WE ARE entering the season when business normally starts a steady, uphill climb toward the Christmas season peak. This year, however, the renewed activity of building new TV broadcasting stations and in changing channels and increasing power on others will probably usher in one of the swiftest periods of growth and expansion this industry has ever experienced. Records will probably reveal that starting in July, when the first of the two very important quadrennial political conventions got underway, the radio-television business has been experiencing a better summer season than it has in a couple of years. The deep and extensive interest in the Presidential candidates and in the issues involved will, in itself, keep public interest in TV at a high level throughout the late Summer and early Fall.

The continuing interest in getting good television programs that these political campaigns will serve to maintain affords an excellent opportunity for creating the "service sales promotional" programs that are needed so badly by TV service businesses in the established TV areas. It is obvious that the "boom" days in the older major TV areas are past. There is no development now on the visible horizon that would impel large numbers of set owners to discard their present receivers and buy new ones. There is no likelihood of a big upsurge in business when new u.h.f. stations go on the air. In short, the television service business in those areas has settled down to the regular maintenance of receivers and accessory equipment now in use with the expansion possibilities tied to the normal increase in set ownership that may be accomplished by good receiver merchandising.

A maintenance and service business may be managed in either of two ways. It can keep its identity known through advertising in the hope that a certain percentage of people who recognize the need for service on their sets will call their number for that service. This plan of operation—if it may be called a plan—causes a business to suffer severely from seasonal slumps in consumer calls for service. In fact, service volume fluctuates so much from month to month in this type of operation that it is unable to take full advantage of the peak periods of business and takes an undue loss during the slumps.

In contrast to this type of service business management, the service business that employs "service selling" programs regularly is able to level up its volume by intensifying these programs during the periods when business is most needed. Television becomes a vital part of the family life in every home where a set is installed. Set owners feel the same need for good, consistent performance from their TV receivers as they want from their automobiles. Auto manufacturers and dealers have sold car owners on the need for regular maintenance work to insure dependable service from their cars. Any television service operator who will institute a "TV set check-up" program on sets in the immediate area of his shop will quickly discover that there are a lot of people who will welcome that kind of service.

This type of maintenance service could include a regular chassis cleaning (a small, suction-type vacuum cleaner as a part of the maintenance technician's kit would be useful and effective for this function), face washing, and an operational check. The set owner's card carried by the technician on these maintenance calls should include a complete record of all radios, record players, and changers and any other electronic equipment that the customer owns. A regular part of the maintenance call should be to inquire about the condition of this other equipment and to check it if there is any question in the customer's mind about whether or not it is operating properly.

This method of business operational planning will not only serve to level up the periods of low business volume but it will also add many extra dollars of service income from replacement parts and repairs on other radio equipment that is normally neglected.

New Channels—More Power

The broadest effects of the renewed activity to expand television broadcasting into unserved areas will probably be felt in the twenty-five current TV areas in which present stations are scheduled to change channels. In shift-

ing channels these stations are authorized to boost their power. This power boost will extend the range of each of these stations by a number of miles, bringing new sections into their fringe areas. These newly opened fringe areas will create new markets for TV receivers and antenna installations while the increase in power and the channel changes will develop a large spot market for touch-up realignments and set adjustments throughout the affected areas.

The kind of "boom" that can hit a fringe area city when a station extends its range through an increase in effective radiated power was dramatically demonstrated in Indianapolis, Indiana, last Spring. Station WTTV in Bloomington, fifty miles distant from Indianapolis, put a new high-gain antenna in service when it increased its power on Channel 10. This put its signal into Indianapolis with sufficient strength to give good pictures wherever a satisfactory antenna system was installed.

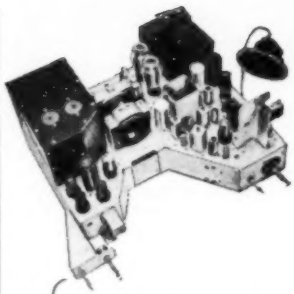
Indianapolis had a Channel 6 station, WFBM-TV, for several years which most set owners were receiving satisfactorily with built-in or indoor antennas. Since there was no effective service association in existence in Indianapolis there was no planned public relations campaign to educate the set owning public about the long-range economy in having Channel 10 antenna systems installed by experts. Set retailers ran ads tieing in Channel 10 antenna installations in a "package" to sell sets, but there was no real program directed to the thousands of set owners who would be in the market for antenna system installations and perhaps a touch-up alignment of their sets on Channel 10. The result was that a large percentage of this new antenna installation work was done either by the set owners themselves or by the host of fringe installers who jumped into the business to make a quick buck.

If the established service businesses in the Indianapolis area had gotten together and pooled their resources to put on a public educational program on the reasons why experienced TV installation companies should be employed to put up antennas and make the necessary set adjustments, it would have prevented a lot of confusion and would have helped to build public acceptance of the importance of employing competent service companies if they want to get top performance from their TV receivers.

Effects of Power Increases

In areas where stations have increased their effective radiated power three new reception problems have arisen. These are: (1) the added power put too much signal in the area close to the transmitter; (2) it extended the co-channel interference belts; and (3) it increased the possibility of adjacent channel spillover.

Tremendous signal levels put a strain on even the more modern a.g.c. systems and particularly if the a.g.c.



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1X2A	.94	6J6	.94	12SK7	.84
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6AT6	.68	6X5	.64	50B5	.86
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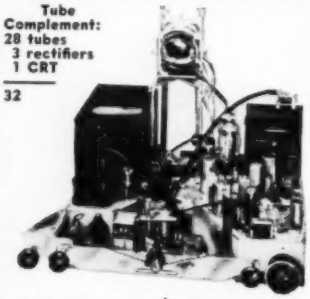

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must be set to receive a relatively weak signal as well as a strong one. The best solution for this condition in many cases is to use a resistor attenuator pad to drop the signal level before it reaches the antenna terminals. Set owners, however, do not understand these technicalities that are peculiar to television. The average set owner knows only that the picture on his receiver is good or bad; if it is bad he wants the trouble corrected as cheaply as possible.

The co-channel interference problem is a difficult one. The too familiar "venetian blind" effect is prevalent throughout the flat Midwestern states and extends into most sections of the country on nights of abnormal refraction (often during hot, humid nights). A highly directional antenna (strictly uni-directional pattern) and careful orientation will help to minimize the interference.

Here again, though, the set owner is ignorant of a serious condition that may affect the quality of the picture on his receiver. When these stations boost their powers many set owners may suddenly find that the quality of the picture they get on the new channel is inferior to what it had been on the former channel. And, unless they are informed in advance about what may happen, there will be a lot of confusion and it will be an extremely difficult job to advise them about the causes of the trouble after the trouble starts.

When there is an increase in effective radiated power, the adjacent channel picture and sound levels are correspondingly higher. This becomes a particularly troublesome problem when strong and weak signals fall on adjacent channels. Technicians must be instructed to align traps carefully—preferably when spillover is observed on the screen.

An antenna with a pattern that can be oriented in the direction of the desired weak station and away from the interfering strong station will be of substantial help. The added selectivity of a booster can make the desired signal dominate adjacent channel interference to a greater extent.

In addition to these reception problems that may occur in every one of the areas where channel changes and power boosts are scheduled, few of the sets now in service will produce the best picture they can deliver without at least a touch-up alignment for maximum response at the new frequency. Since most TV set owners think of tuning in TV stations as being about the same as switching stations on their old push-button radios, there may be a lot of consternation among set owners who are not familiar with the need for alignment when they tune in these stations on their new channels.

Both parts distributors and legitimate TV service businessmen in these twenty-five areas which are slated for channel changes should pool their efforts in conducting educational programs for TV set owners, advising them about what they may expect in the way of reception troubles when the station changes its channel and what to do about it if it occurs.

These campaigns should be put in effect in advance of the change in channels. When set owners understand the reasons why service may be needed when the change is made they will most likely arrange with an established service company to handle the adjustments on their receivers if they are necessary. A planned program of this kind will do much to eliminate the confusion that causes many set users to turn to the first technician who offers his services when unexpected troubles occur.

Immediate Effect of New Stations

The new stations that will get the "go ahead" as the Federal Communications Commission proceeds with its program of granting channel assignments and issuing station construction permits will have a sectional effect on the TV business. The priority schedule recently released by the FCC shows that sections of eighteen states will be affected in the first twenty-five cities to be considered for new—and their first—telecasting stations.

Of these 25 cities, five have channel allocations only in the u.h.f. band. Assuming that construction permits are granted for u.h.f. stations in these cities they will become the center of attention of all segments of the industry. They will probably be the "proving ground" for u.h.f. receivers, equipment and accessories.

The Springfield-Holyoke, Mass., area tops the u.h.f. priority list with Channels 55 and 61 available to broadcast station applicants. Youngstown, O., is second with Channels 27, 33, and 73 assigned to that area; then follows Fort Wayne, Ind., with Channels 21, 27, and 33; Scranton, Pa., with Channels 16, 22, and 73, and South Bend, Ind., to which Channels 34, 40, and 46 have been assigned.

Of these five areas the Youngstown, Ohio, section will undoubtedly provide some of the most useful information on the extent and limitations of reception in the u.h.f. band.

It is quite possible that some of the major television service contractors will set up small branches in the first u.h.f. areas in order to acquire first-hand experience with the problems of installation, alignment, and servicing that will be created by propagation at these higher frequencies.

Denver, Colo., heads the entire list of cities for priority consideration for station assignments. With Channels 2, 4, 6, 7, and 9 in the v.h.f. region and Channels 20 and 26 in the lower end of the u.h.f. band allocated to that city, Denver will experience lively activity in TV station construction and receiver sales and installations. Portland, Ore., follows with v.h.f. Channels 6, 8, 10, and 12 and u.h.f. Channels 21 and 27 available for stations. Other cities on the list for priority consideration of v.h.f. applications include Tampa-

St. Petersburg, Fla., with Channels 3, 8, and 13 available; Wichita, Kans., where Channels 3 and 10 are open; Flint, Mich., due for a Channel 10 station; Spokane, Wash., for Channels 2, 4, and 6; Duluth, Minn., Channels 3, 6, and 8; and Sacramento, Cal., with Channels 3, 6, and 10 allocated.

Assn. Distributor Cooperation

One city that has been little affected by television service racketeers is Columbus, Ohio. A strong, aggressive service association, the Associated Radio-Television Service Dealers of Columbus, has been functioning in that city for many years. It started originally as a radio service association but made a quick transition to cover television when telecasting started in that area. However, even with such a strong association of conscientious service businessmen cooperating with the Better Business Bureau, the Columbus newspapers and the parts and set distributors, once in a while a service "sharpie" managed to edge his way into the business. It required a high order of cooperation between the better business elements to weed out those slick operators who managed to work themselves into the business.

One of the major reasons for the success of the ARTSD in keeping the service industry free from racketeering has been the cooperation they have had from all set and parts distributors in the city. The focal point of this program of cooperation is the quarter-annual dinner meetings which bring Association members together with distributors for discussions of mutual problems. Activities of common interest are discussed at these meetings, gripes are aired, and points of contention are freely discussed in an atmosphere of mutual respect and cooperation. Because of this cooperative activity the citizens of Columbus are assured of efficient, reliable service unexcelled in any other city.

In attending a recent joint meeting of the ARTSD with their distributors, the editor of this department was able to observe at first-hand why this program has worked so successfully. The meeting, which was presided over by Fred C. Colton, dynamic president of ARTSD and the originator of many fine technical training ideas now used by a number of organizations, was attended by a representative of the Columbus Better Business Bureau, a local newspaper columnist, top level executives of the parts and set distributing organizations, and members of the Association.

The BBB representative discussed the type of complaints they were receiving, how they were being handled, and gave an analysis of the results. He also outlined the actions that had been instituted to keep the last of the local service racketeers under control. Representatives of the various organizations were invited to voice their opinions on any subject of common interest and the parts distributors reported on new equipment shown at the annual

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Tuning Units for APR-4 Receiver, ... New & Like New	PUR*
BC-348, BC-312, BC-342 Receivers, ... New & Like New	PUR*
Communication Receivers—made by Hallicrafters, National, & Hammarlund. Many models ..... Prices start	79.50
T-47/ART-13 Transmitter	PUR*
Measurements Corp. Signal Generator Model 84 300-1000mc. ..... Exc.	PUR*
PU-14 Inverter Input 24 VDC, Output 115 V., 3 Phase, 400 C.P.S. 5 amps ... Exc.	PUR*
T-17 Hand Microphone with cord and PL-68. ..... Exc.	4.50
HS-23 8000 ohm ..... Used	$2.95. New 5.95
HS-18 8000 ohm ..... Used	1.75. New 2.25
HS-33 600 ohm ..... Used	3.50. New 6.95
HS-38 600 ohm ..... Used	1.75. New 2.25

*PUR—Price upon request.

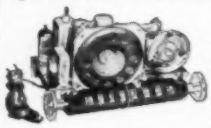
NOTE: One of the largest and most complete electronic surplus stocks in the country. We have thousands of tubes, capacitors, plugs, accessories, transmitters-receivers, test equipment, etc. Send us your requirements.

TERMS: Prices F.O.B. Pasadena, California. 25% on all C.O.D. orders. Californians add 3% Sales Tax. Prices subject to change without notice.

FOR A FEW CENTS MORE YOU CAN GET THE ORIGINAL AND MOST RELIABLE PRODUCT OF ITS TYPE. WHY RISK YOUR REPUTATION TO SAVE A FEW PENNIES? ORDER FROM YOUR DISTRIBUTOR

Back Again By Popular Request!

Special Purchase FM Radio Chassis



88-108 MC

Complete with 6 tubes. Built-in Antenna and Speaker. Product of Famous Radio & TV Manufacturer whose name we promised not to mention.

TUBE LINEUP

1-12BA7 1-12S8
2-12BA6 1-35W4
1-35B5

Regularly $29.95
Brand New

May also be used as an FM Tuner by picking signal off detector.

$16.95

Maroon Plastic Cabinet for above..... **$5.95**

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Two Station Intercom System

Less than half the original price. Built for America's leading dep't store chain, whose name we cannot mention because of this low price. Consists of master station, remote station and 20 ft. of 3 conductor wire. Can be used as a private or non-private system. 115V AC or DC. Brand New. Now only $17.95. Additional wire, per ft., 5c.

VARIABLE CONDENSERS
From SCR-522
2-GANG 25 MMF
Per Section $1.29
3-GANG 25 MMF
Per Section $1.59
Brand New with Concentric Air Trimmers

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now only
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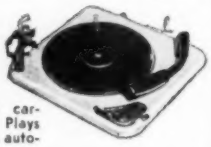
SPECIAL PURCHASE Record Changer
Gen. Instruments 3-speed Automatic

Reg. $34.95
Brand New

$19.97



With all purpose cartridge & needle. Plays 33⅓-45 RPM records automatically.

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We've bought up a tremendous supply of these and now you can buy them below manufacturer's 5000 lot prices.

10 WATT FIXED		10 WATT ADJ.	
1-1000 ohms	List....$ .75	1-1000 ohms	List....$1.47
1100- 5000	.80	1250- 5000	1.53
6000-10,000	.92	6000-10,000	1.61
11,000-20,000	1.03	Your Cost. Each	.39
22,500-25,000	1.08		
30,000-50,000	1.22	20 WATT FIXED	
Your Cost. Each	.24	5-1000 ohms	List....$ .95
		1200- 5000	.97
25 WATT ADJ.		6000- 10,000	1.12
1-1000 ohms	List....$1.87	12,500- 20,000	1.20
1250- 5000	1.88	25,000- 40,000	1.37
6000-10,000	2.03	45,000- 60,000	1.58
12,000-20,000	2.08	65,000- 80,000	1.81
25K	2.25	85,000-100,000	2.11
Your Cost. Each	.47	Your Cost. Each	.36

50 WATT ADJ.		100 WATT ADJ.	
1-1000 ohms	List....$2.37	1-1000 ohms	List....$3.58
1250- 5000	2.47	1500- 5000	3.67
6000-10,000	2.63	10,000	3.87
12,000-20,000	2.83	15,000-20,000	4.12
25,000-40,000	3.08	25,000-40,000	4.37
50,000-60,000	3.30	50,000	4.53
75,000	3.67	75,000	4.75
100,000	3.92	100,000	4.95
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Deduct 10%—Lots of 100 or more. Deduct 20%—Lots of 1000 to 10,000. Minimum Order—$2.00.

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TERMS: All items F.O.B., Washington, D. C. All orders $30.00 or less, cash with order. Above $30.00, 25 per cent with order, balance C.O.D. Foreign orders, cash with orders, plus exchange rate.

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Electronics Parts and Equipment Show in Chicago.

The speaker for the evening's meeting was Paul H. Wendel, managing director of the Television Technicians Lecture Bureau, who discussed "Areas of Cooperation Between Parts Distributors and Servicing Organizations." He pointed out that the industry is standing on the threshold of the period that will witness its greatest expansion. While attention has been focused on television for home entertainment, great strides have been made in the development of television for industrial and commercial applications and the entire field of industrial electronics will open up vast new opportunities for parts distributors and competent independent service companies.

Taking the specific subject of industrial television, the speaker described the work that has been accomplished by the Lecture Bureau staff in developing an industrial TV camera unit that could be priced so low that it could be sold for use in a myriad of applications. He cited the following as just a few of these possibilities: 1. Window advertising displays; 2. Store-room pick-up of customers as they enter shop; 3. Monitoring of small plant operations; 4. Store-room advertising displays; 5. Use in service shops as a piece of test equipment. Also use as a source of signal to check receiver performance; 6. Estate and farm applications; 7. Remote observation of recording instruments; 8. Applications in various departments of local governments; 9. Novelty and other applications at night clubs, carnivals, fairs, auditoriums, etc.; and 10. Television operations studies for radio amateurs, students, and experimenters.

Since every installation will have to be tailored to accomplish a specific purpose, industrial television will require the services of competent installation and maintenance organizations. It is a natural field for independent TV service organizations.

The speaker pointed out, however, that servicing organizations should be studying industrial television now in order to be prepared and equipped to move into the business quickly when it starts to develop.

Readers of this department who are interested in the subject of industrial television may obtain a copy of a bulletin on it by sending a stamped, addressed envelope to: The Service News Editor, RADIO & TELEVISION NEWS, 366 Madison Ave., New York 17, N. Y.—30—

"Will whoever has the remote control gadget stop playing with the channels!"

TELEPHONE EQUIPMENT & PARTS

New TS9 Handsets with butterfly switch	$6.50
Rebuilt TS9 Handsets with new shell....Each	4.95
Rebuilt Solid Type Handset with new 3 conductor cords....Each	4.95
New Western Electric Handsets with rubber cord & PL47 plug....Each	7.50
New Receiver & Transmitter Elements interchangeable with W.E. Elements F1 & HA1. Each	1.00
Reconditioned Upright Desk Telephones (for intercoms, extensions, etc.)....Each	2.95
W.E. 202 Desk Telephones....Each	8.50
New 6-Foot Rubber Cords with Alligator clips. Each	.60
New Weatherproof Cook Commando type Pole Jacks....Each	1.00
New W.E. UA 38 Relays....Each	2.50
New, unused R.C.A. Amplifiers—90 Watt, 50-60 Cycles, 105-125 Volts, with spare part kits.	

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ABSOLUTELY THE GREATEST CABINET BUY IN YEARS.

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No tubes, batteries, adjustments, license or permit needed! Guaranteed to work anywhere up to ¼ mile with extra wire. Swell for garage to house, etc.! Your own private, talk-listen phone. Not war surplus. Brand new. Solid Aluminum Case. Two complete units with wire—READY TO USE! SEND ONLY $1.00 deposit and pay postman $3.99 C.O.D. or send $4.99 for PP delivery. Sold only by mail from: MIDWAY CO., Dept. WRT-8, KEARNEY, NEBRASKA.

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AC/DC Operation
TEST INSTRUMENTS
Write for FREE Catalog
ARKAY—Radio Kits, Inc.
120 Cedar St. New York 6, N. Y.
KITS

The TV Picture Tube

(*Continued from page* 50)

current, and the proper type of ion trap for each tube. If it is desired to replace a tube with a similar type be sure that all values given in the "Data-Print" for both tubes are almost identical. A variation of 2 kv. in second anode voltage, 5 ma. in focusing current and ¼ inch in length will not affect the tube's operation, but larger deviations will often require circuit modifications. When a metal shell tube is used be sure to obtain the correct plastic insulating frame and apron. Another frequent source of difficulty is the variation in high-voltage terminals used for the second anode. When the new tube requires a different type of terminal it is best to purchase the correct mating part rather than use a makeshift arrangement which will later produce arcing or corona.

Picture tube screens come clear, with a filter glass, or etched. The latter two type screens are designed to reduce glare. A third type of glare-reducing tube has recently been introduced. It has a cylindrical outer face to reduce reflections from incident light. A few new tubes combine two or more of these features.

Practically all picture tubes use the same 6.3 volt, 0.6 amp. filament, which permits us to neglect this item in any changes of picture tubes.

On studying the tube chart on the "Data-Print" it appears that some of the more recent large-screen tubes are identical although different numbers are assigned them. In most cases the differences are in gun structure, external conductive coating, and other minor variations which do not affect the function of the tube. If a tube having an external coating is used, some means of grounding this coating must be provided and almost all TV sets have a ground spring, clip, or other contact for that purpose.

It would be impossible to mention all the details and different features of the host of TV tubes now in use, but the chart will answer all pertinent questions which arise in either replacement or conversion work. Just be sure to check every one of the columns for both the new and old tube and make a note of the differences. Then it can be determined whether these differences can be overcome and how, or if a different tube type offers some advantages.

—30—

Industrial Electronics

(*Continued from page* 64)

on the negative alternations. In this manner, relay chattering is prevented even though an alternating voltage is used on the plate of the tube.

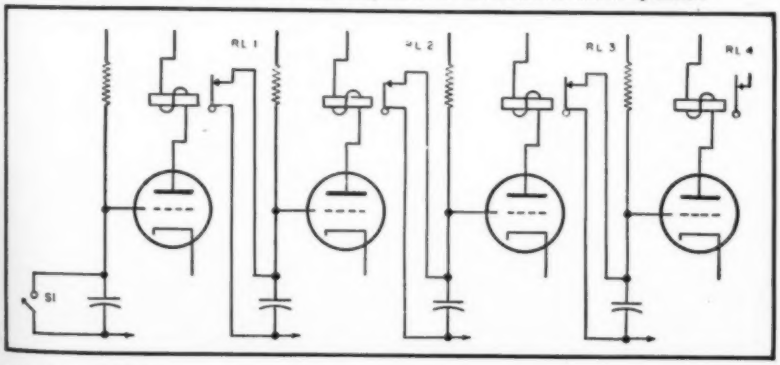
The potentiometer to which the grid is connected serves as a voltage divider across the power lines, and determines the voltage to which the condenser charges. Since a larger voltage will take longer to discharge, the potentiometer serves to control the duration of the timing interval.

Sequence Timing

In many applications, resistance welding for instance, power is alternately applied and disconnected. The "power on" intervals may be of the same or different durations, and they may be uniformly or irregularly spaced. Electronic timers control such complex sequences with precision and reliability. The sequence timer consists of two or more time delay circuits connected in cascade. Fig. 4 shows the diagram of a sequence timer made up of four circuits like that of Fig. 1. To start the timing sequence, switch 1 is opened. After an interval of time relay 1 is energized. This relay has normally-closed contacts which serve as the switch for the second timing circuit. In this manner, when relay 1 is energized it initiates the timing interval in the second circuit; when the second relay closes, it initiates the time delay in the third circuit, etc. The relay in the last circuit may be connected back to the first in order to repeat the same timing sequence over and over. Additional contacts on each relay serve to apply or disconnect the power of the associated equipment.

—30—

Fig. 4. The sequence timer consists of several time delay circuits connected in cascade. The contacts of each relay serve as the switch for following circuit.



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Combines in one central panel complete tone compensation, phonograph equalization, and control of all audio channel switching.

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- Cathode follower output permits extremely remote installations without loss of response.
- The first preamplifier performance-matched to the Craftsmen 500 Ultra-Fidelity audio amplifier.

HAVE YOU HEARD the C500? Williamson all-triode circuit. It's 99.99% distortion-free!

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RADIO Surplus Buys

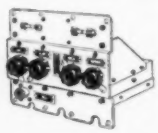
500 KC CRYSTALS

500 KC Crystals in FT 241-A holders with ½" pin spc.

ONLY LIMITED QUANTITY AVAILABLE

$1.95 ea.

TUNER FROM NAVY "BN" EQUIPMENT



Simply modified into 2-meter converter for car or communications receiver. Uses 1—6J6, 1—6SH7, 1—9006, 1—6J5 (Not Furnished).

Slug is tuned from 157 to 187 Megacycles. Includes schematic diagram for "BN" equipment.

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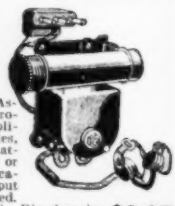

Complete Contact Mike Assembly includes: Two microphones, on-off switch, amplifying transformer, batteries, battery case. Connector to attach to any radio, AC, DC or battery portable. Amplification up to full volume output of radio or sound system used.

FB for watch or clock repair, Diesel engine injector adjustment, gas engine diagnosis, etc. **Specially Priced at..... $3.95** Postpaid

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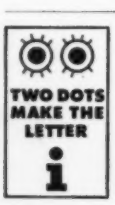

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AUG. 1952

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

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